Disorders of the Pleura, Mediastinum, and Chest Wall

Disorders of the Pleura

Pleural Disease

- pleura is a thin membrane
  - **two pleural membranes:**

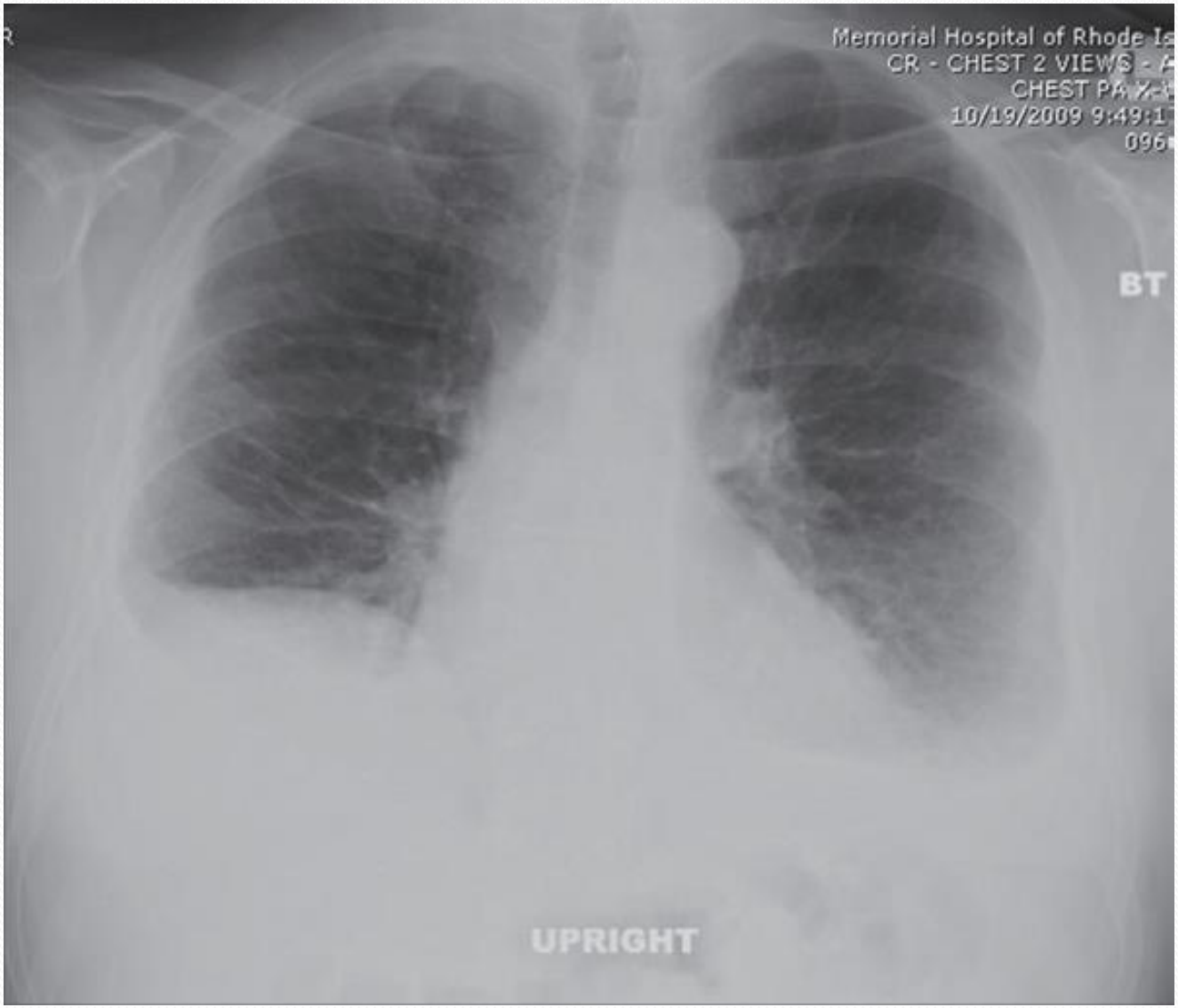
- **visceral pleura**, which covers the lung;
- **parietal pleura**, which lines the rib cage, diaphragm, and mediastinum.

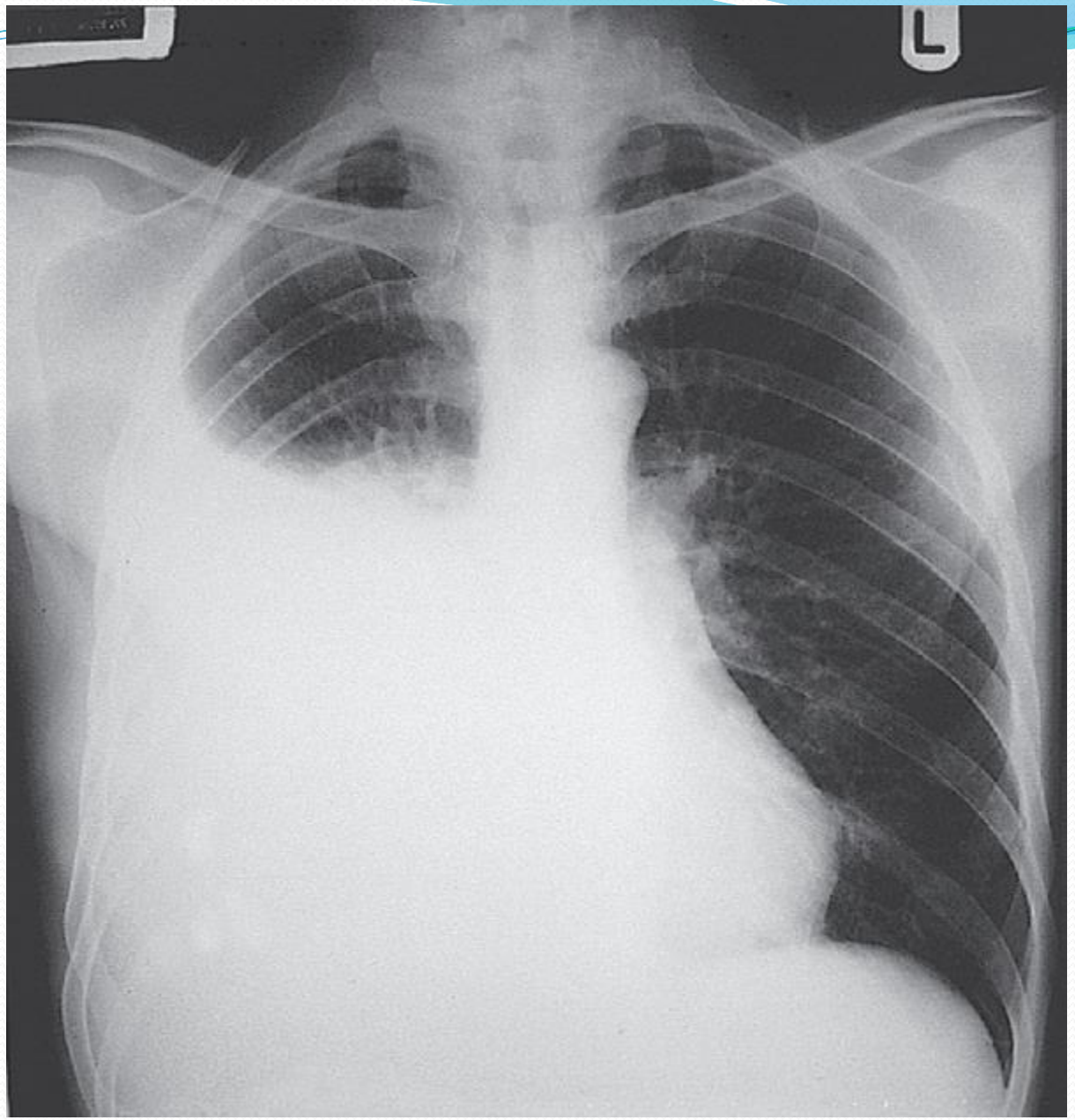
Pleural fluid

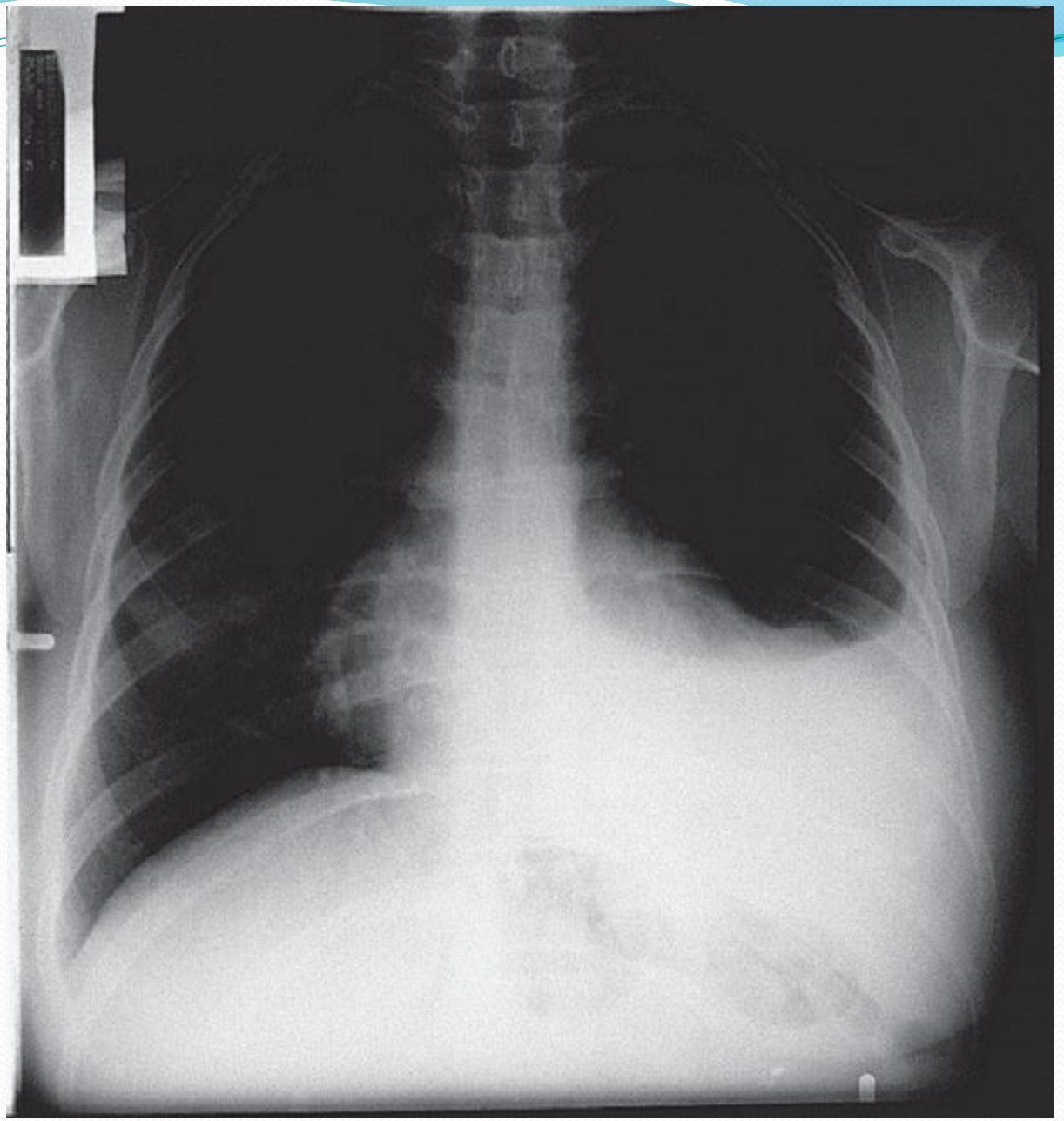
- 0.2 to 1 mL

Pleural fluid

- lubricant for the visceral and parietal pleura


Memorial Hospital of Rhode Is
CR - CHEST 2 VIEWS - A
CHEST PA
10/19/2009 9:49:1
096
BT
UPRIGHT


L



Pleural fluid

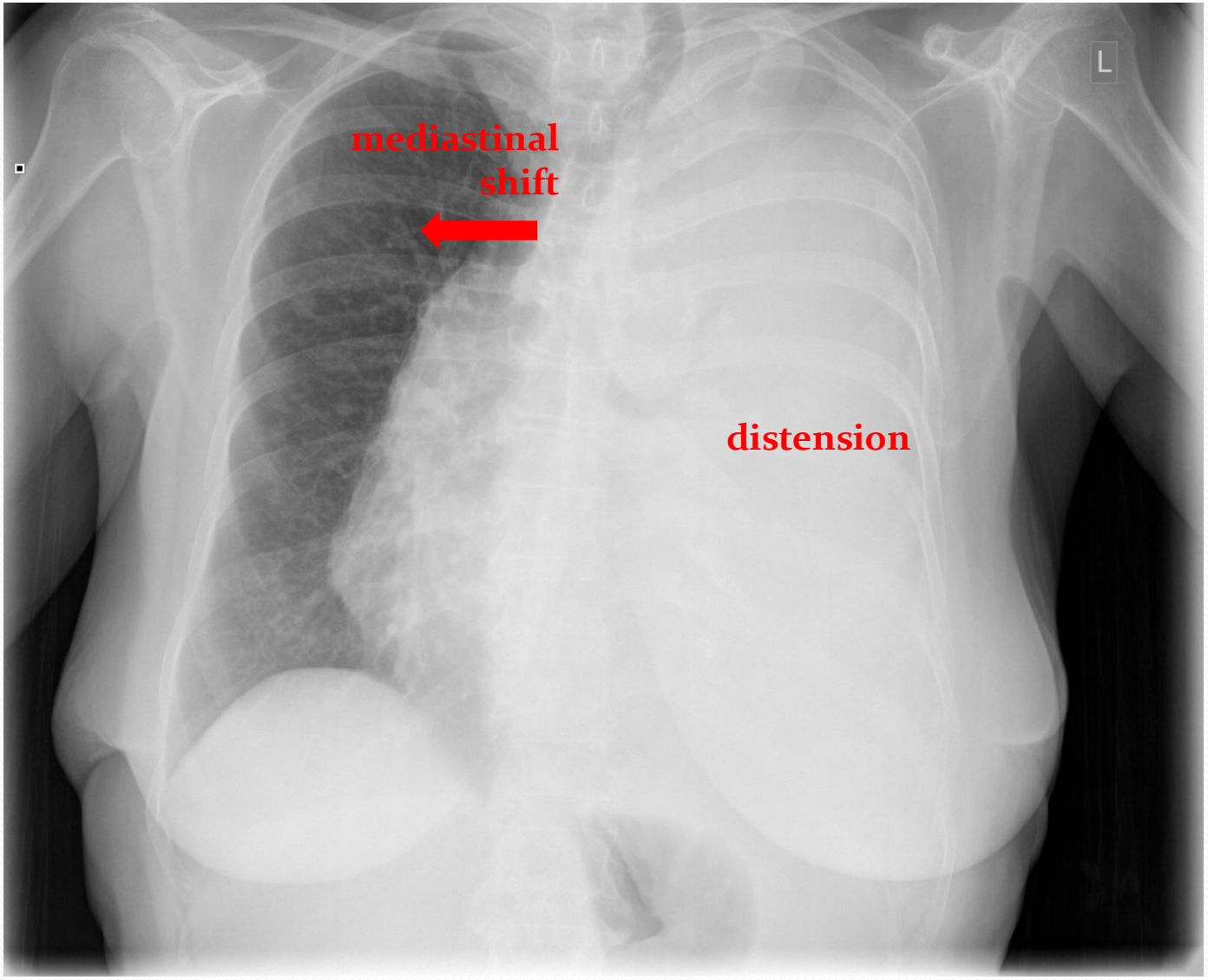
- Increase in systemic venous pressure
- Increase in pulmonary venous pressure
- Increase in permeability of pleural vessels
- Reduction in pleural pressure

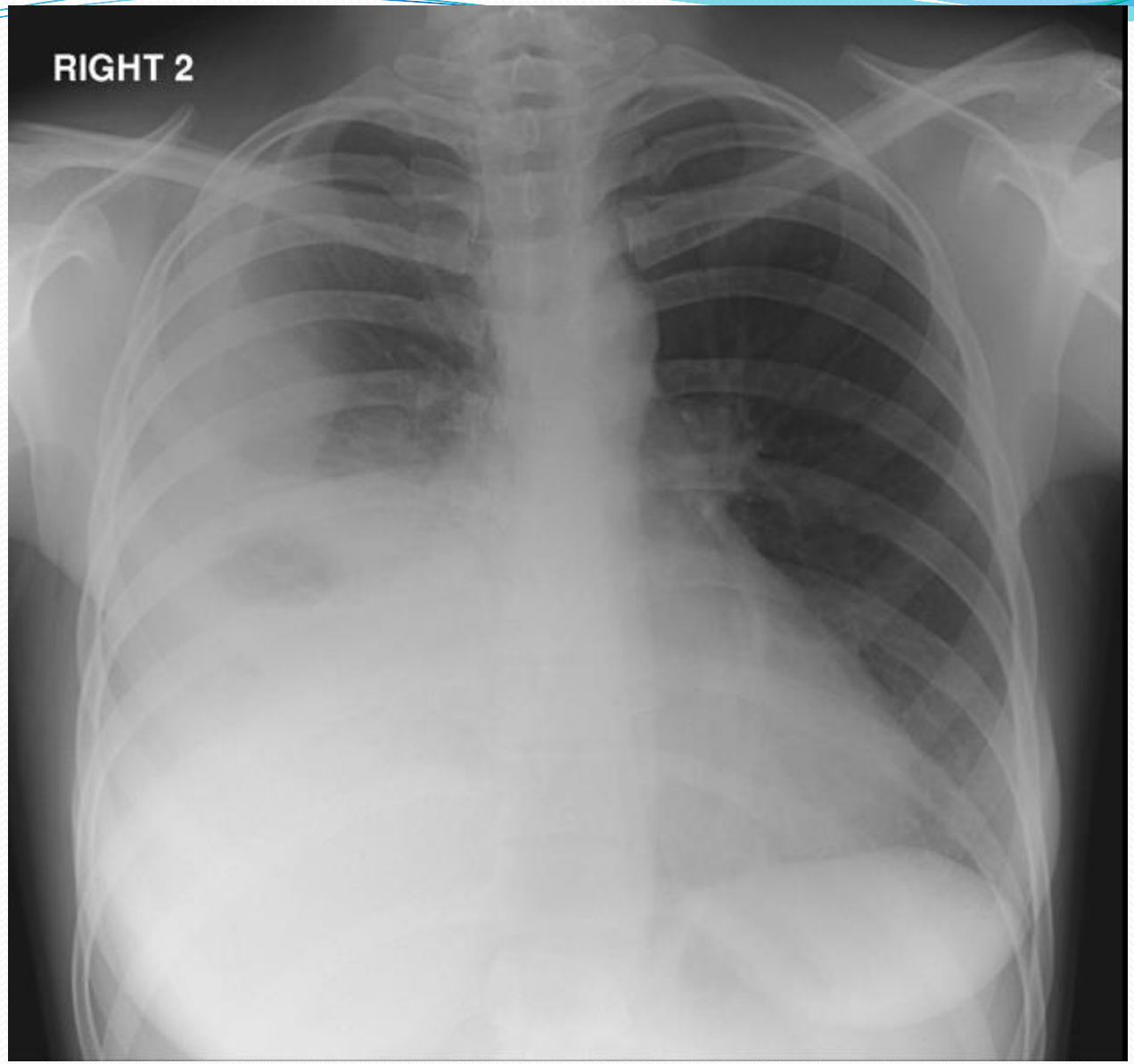
PLEURAL EFFUSION

- chest radiography;
- exceed 250 mL
- blunting of the costophrenic angle on a PA chest film
- fluid can be demonstrated in either the minor or major fissures
- A decubitus chest radiograph

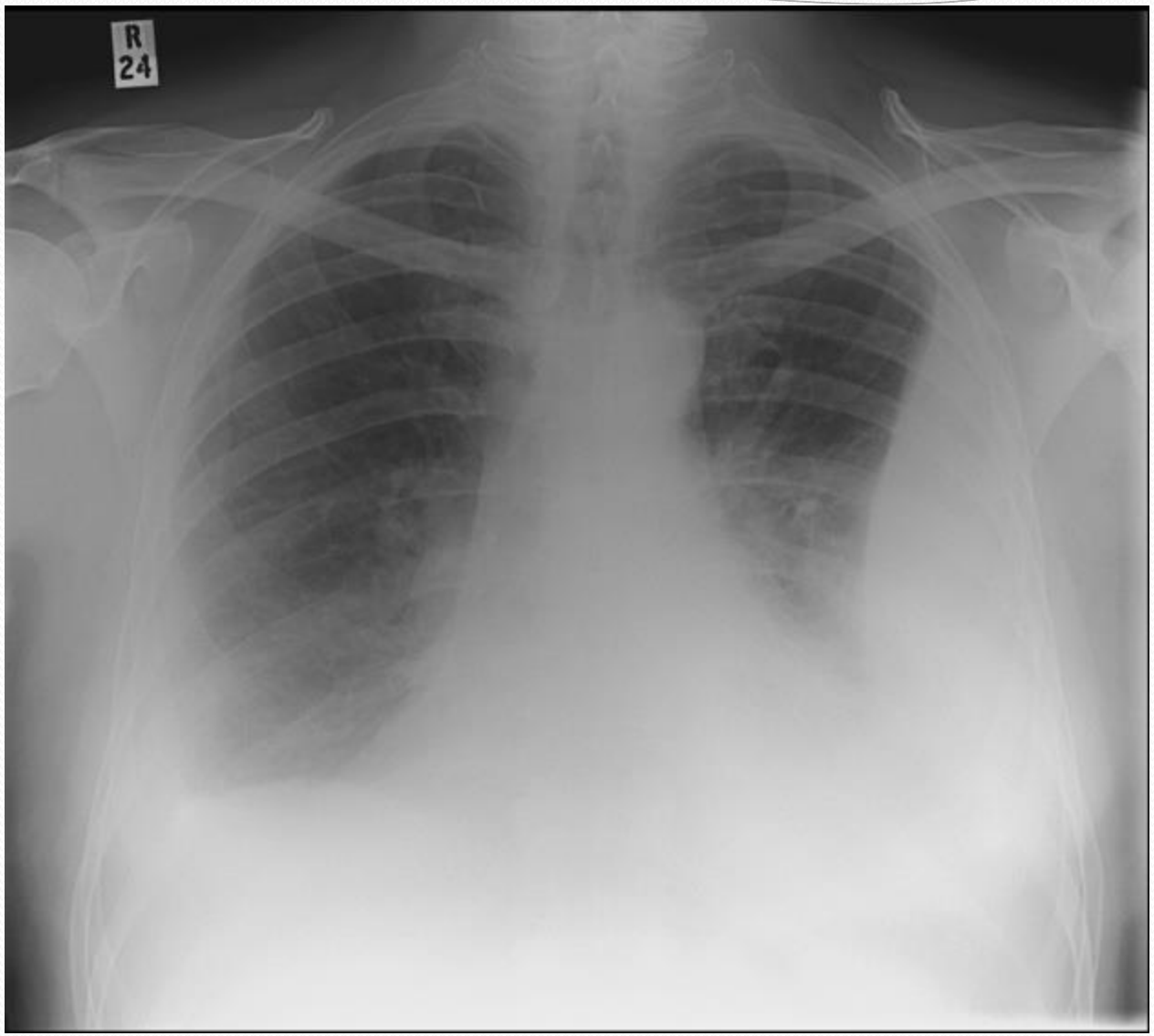
- Fluid is free-flowing or loculated

Massive pleural effusion

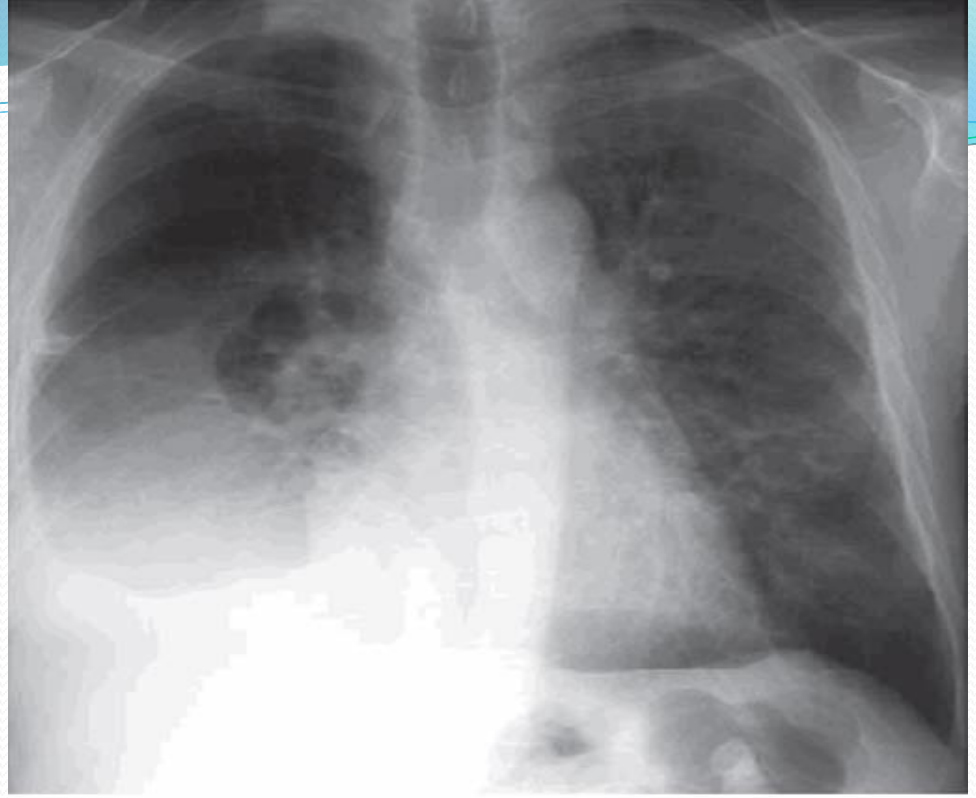




Right pleural effusion with mid zone consolidation



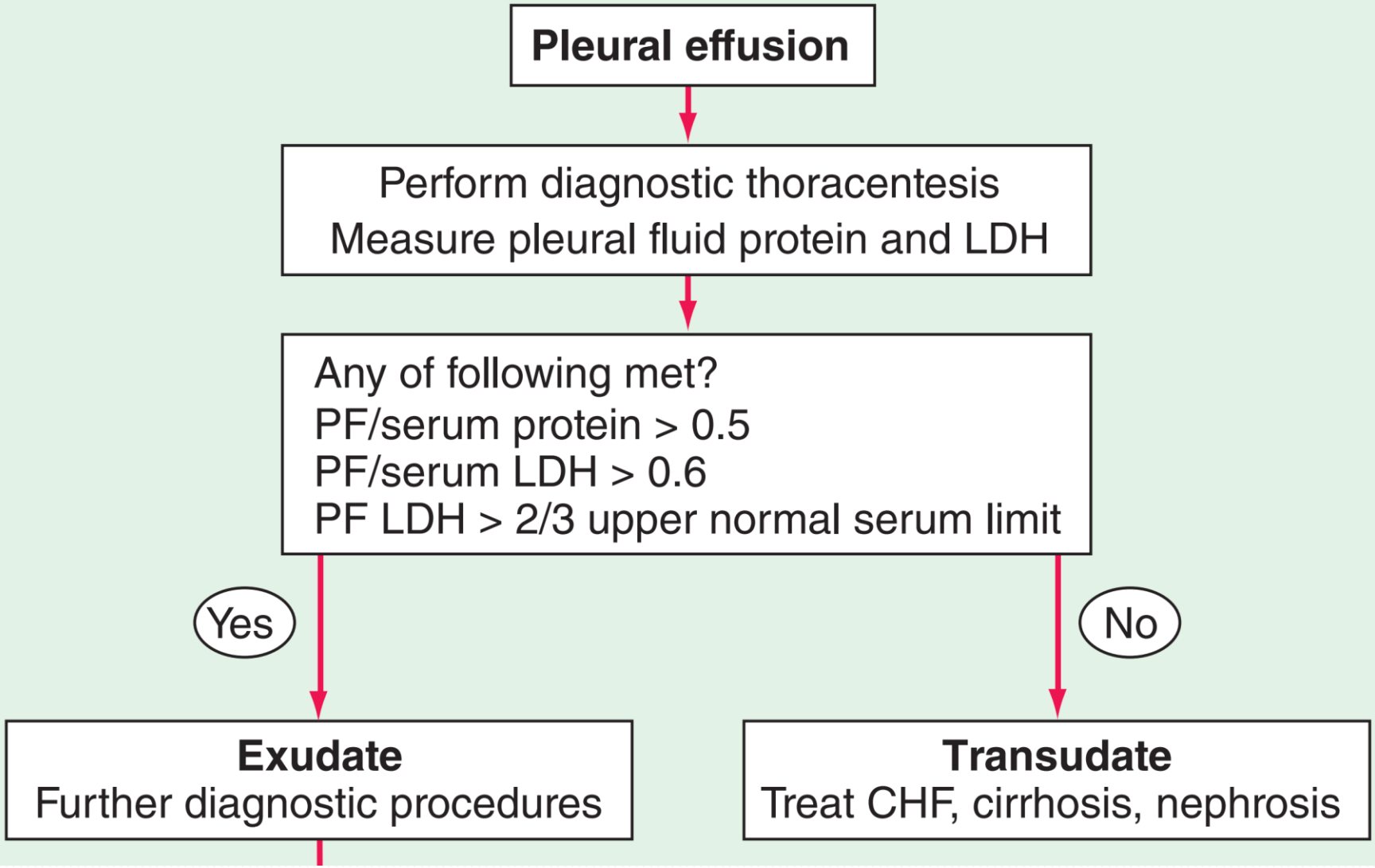
Empyema

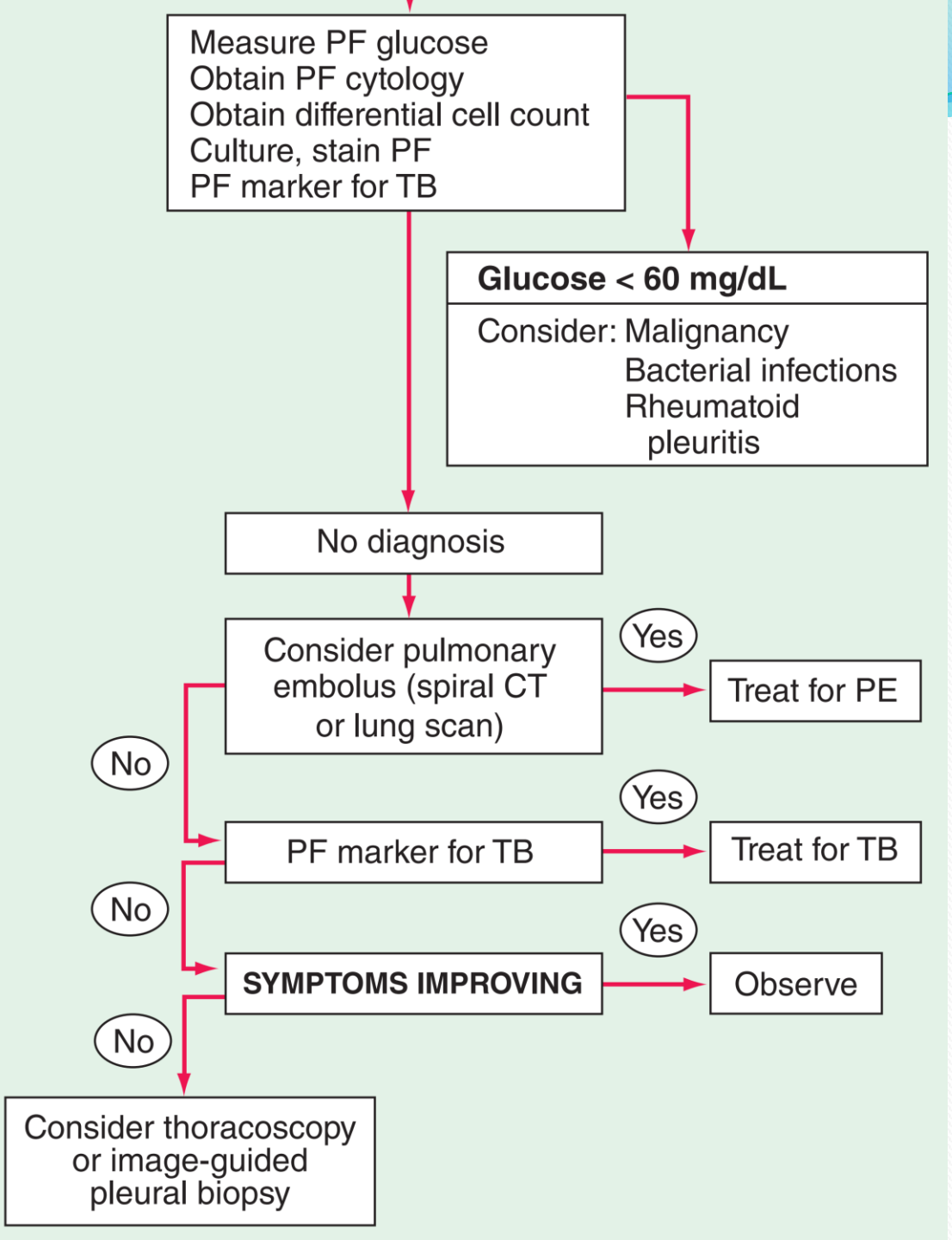


PLEURAL EFFUSION

Table 21-2 **Differentiation of Exudative and Transudative Pleural Effusions**		
	Exudate	**Transudate**
Protein	>3 g/dL	<3 g/dL
Pleural and serum protein	>0.5	<0.5
LDH	Two thirds the upper limit of normal	Two thirds the upper limit of normal
Pleural and serum LDH	>0.6	<0.6

Diagnostic Algorithm of Pleural Effusion




Measure PF glucose
Obtain PF cytology
Obtain differential cell count
Culture, stain PF
PF marker for TB
Glucose < 60 mg/dL
Consider: Malignancy
Bacterial infections
Rheumatoid pleuritis
No diagnosis
Consider pulmonary embolus (spiral CT or lung scan)
Yes
Treat for PE
No
PF marker for TB
Yes
Treat for TB
No
SYMPTOMS IMPROVING
Yes
Observe
No
Consider thoracoscopy or image-guided pleural biopsy

TRANSUDATES

- Effusions that accumulate due to

- changes in osmotic and hydrostatic forces usually have low protein states and are considered transudates

TRANSUDATES

- Congestive heart failure

- typically bilateral
- right hemithorax
- dysfunction of the left side of the heart, not the right side of the heart

Transudative Pleural Effusions

1. Congestive heart failure
2. Cirrhosis
3. Nephrotic syndrome
4. Peritoneal dialysis
5. Superior vena cava obstruction
6. Myxedema
7. Urinothorax

Exudative Pleural Effusions

1. Neoplastic diseases
   a. Metastatic disease
   b. Mesothelioma
2. Infectious diseases
   a. Bacterial infections
   b. Tuberculosis
   c. Fungal infections
   d. Viral infections
   e. Parasitic infections
3. Pulmonary embolization
4. Gastrointestinal disease
   a. Esophageal perforation
   b. Pancreatic disease
   c. Intraabdominal abscesses
   d. Diaphragmatic hernia
   e. After abdominal surgery
   f. Endoscopic variceal sclerotherapy
   g. After liver transplant

Exudative Pleural Effusions

5. Collagen vascular diseases
    a. Rheumatoid pleuritis
    b. Systemic lupus erythematosus
    c. Drug-induced lupus
    d. Sjögren syndrome
    e. Granulomatosis with polyangiitis (Wegener)
    f. Churg-Strauss syndrome
6. Post-coronary artery bypass surgery
7. Asbestos exposure
8. Sarcoidosis
9. Uremia
10. Meigs' syndrome
11. Yellow nail syndrome

Exudative Pleural Effusions

12. Drug-induced pleural disease
    a. Nitrofurantoin
    b. Dantrolene
    c. Methysergide
    d. Bromocriptine
    e. Procarbazine
    f. Amiodarone
    g. Dasatinib

Exudative Pleural Effusions

13. Trapped lung
14. Radiation therapy
15. Post-cardiac injury syndrome
16. Hemothorax
17. Iatrogenic injury
18. Ovarian hyperstimulation syndrome
19. Pericardial disease
20. Chylothorax

EXUDATES

- Alteration in vascular permeability and can be observed in inflammatory states, with infection, or with neoplasm

Complicated exudative effusions

1. Loculated pleural fluid
2. Pleural fluid pH <7.20
3. Pleural fluid glucose <3.3 mmol/L (<60 mg/dL)
4. Positive Gram stain or culture of the pleural fluid
5. Presence of gross pus in the pleural space

Complicated exudative effusions

- thoracotomy and decortication.

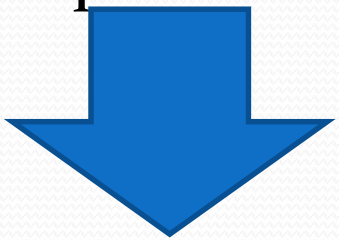
Complicated exudative effusions

- **due to infections need drainage to**

- avoid sepsis
- prevent development of loculation
- cutaneous fistulas
- lung abscess
- Bronchopleural fistulas
- fibrothorax

EXUDATES

- Not specific for infection



- Malignancy
- Rheumatoid arthritis
- Trauma with esophageal disruption

Hepatic Hydrothorax

- Pleural effusions occur in ~5% cirrhosis and ascites.
- Direct movement of peritoneal fluid
- usually right-sided
- large enough to produce severe dyspnea

Effusion Secondary to Pulmonary Embolization

- undiagnosed pleural effusion
- Dyspnea is the most common symptom
- pleural fluid is almost always an exudate
- pulmonary arteriography
- Treatment is the same for any patient with PE

Effusion Secondary to Pulmonary Embolization

- If the pleural effusion increases in size after anticoagulation

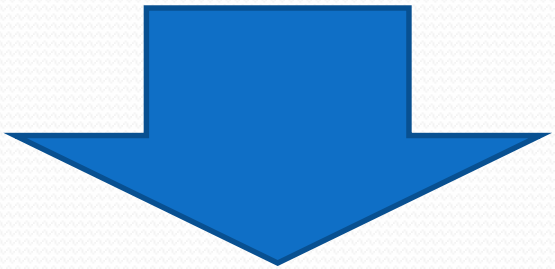
- recurrent emboli
- hemothorax
- pleural infection

Pleural effusions

- **primary tuberculosis**
- up to 30% of patients in endemic areas
- **hypersensitivity reaction**
- **not due to direct infection.**
- lymphocyte predominant
- culture negative for acid-fast bacilli
- Adenosine deaminase levels > 50 U/L

Tuberculous empyema

- distinct from tuberculous pleural effusions



- thoracic lymph nodes into the pleural space
- hematogenesis spread of tuberculosis to the pleural space

Malignant effusions

- second most common cause of exudative pleural effusions
- poor prognosis
- Seeding of the parietal or visceral pleura with malignant cells

Individual with malignancy

- **Effusions in these individuals may be due to**
- Atelectasis
- Postobstructive pneumonia,
- Hypoalbuminemia
- pulmonary emboli
- complications from radiation or chemotherapy

Malignant effusions

- lung cancer
- breast cancer
- lymphoma

bilateral effusions with a normal heart size

bloody effusion

- **Suggests a malignant process**
- Trauma
- Tuberculosis
- Collagen vascular disease
- Thromboembolic disease

Confirm the diagnosis of malignancy

- **cytologic examination of the fluid**

- Malignant cells can be seen in 60% on the first thoracentesis.
- Sensitivity rises to 80% if three separate samples are obtained

Confirm the diagnosis of malignancy

- **Biopsies**

- Video assisted thoracoscopy
- blinded fashion(through a Cope or Abrams needle)

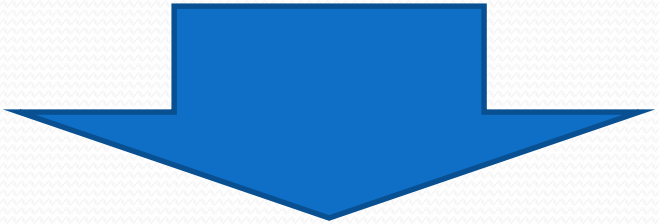
Recurrent malignant pleural effusions

- chemical pleurodesis
- talc
- tetracycline derivatives

- complete response in little more than 50%

Effusion Secondary to Viral Infection

- undiagnosed exudative pleural effusions
- no diagnosis is established for ~20% of exudative effusions
- resolve spontaneously
- with no long-term residua
- not be too aggressive in trying to establish a diagnosis



- particularly if the patient is improving clinically

Exudative effusions

- Rheumatoid arthritis
- lupus erythematosus

Exudative effusions

- **Rheumatoid pleural effusions**

- **common intrathoracic manifestation**
- **many as 5% of patients**

- Pleural fluid rheumatoid factor is often > 1 : 320
- Pleural fluid glucose is less than 60 mg/dL
- pleural fluid–to–serum glucose ratio is less than 0.5

A low glucose

- **Rheumatoid pleural effusions**
- Complicated parapneumonic effusions or empyema
- Malignant effusion
- Tuberculosis pleurisy
- Lupus pleuritis
- Esophageal rupture

Exudative effusions

- Systemic lupus erythematosus
- 15% to 50% of patients

- pleural fluid antinuclear antibody titer is > 1 : 160

Pleural fluid amylase

- Amylase greater than the upper limits of normal for serum amylase is consistent with

- Acute pancreatitis
- Chronic pancreatic pleural effusion
- Esophageal rupture
- Malignancy

Pleural fluid amylase

- Pancreatic disease
- pancreatic isoenzymes amylase
- malignancy and esophageal rupture
- salivary isoenzymes

Chylothorax

- thoracic duct is disrupted and chyle accumulates in the pleural space
- ***trauma*** (most frequently thoracic surgery),
- ***tumors*** in the mediastinum
- dyspnea, and a large pleural effusion
- Thoracentesis reveals milky fluid
- triglyceride level that exceeds 110 mg/Dl
- no obvious trauma ⇒ lymphangiogram and a mediastinal CT
- insertion of a chest tube plus the administration of octreotide
- percutaneous transabdominal thoracic duct blockage
- ligation of the thoracic duct
- ***not undergo prolonged tube thoracostomy with chest tube drainage***
- ***malnutrition and immunologic incompetence***

Hemothorax

- thoracentesis reveals bloody pleural fluid
- If the hematocrit > one-half of that in the peripheral blood
- ***trauma;***
- ***rupture of a blood vessel***
- ***Tumor***
- tube thoracostomy
- If the pleural hemorrhage exceeds 200 mL/h,
  - angiographic coil embolization
  - thoracoscopy
  - thoracotomy

after coronary artery bypass surgery

- commonly occur
- first weeks
  - left-sided and bloody
  - large numbers of eosinophils
  - respond to one or two therapeutic thoracenteses.
- after the first few weeks
  - left-sided
  - clear yellow
  - predominantly small lymphocytes
  - tend to recur

PNEUMOTHORAX

PNEUMOTHORAX

- accumulation of air in the pleural space
- pleural pressure becomes positive,
- compression of underlying lung

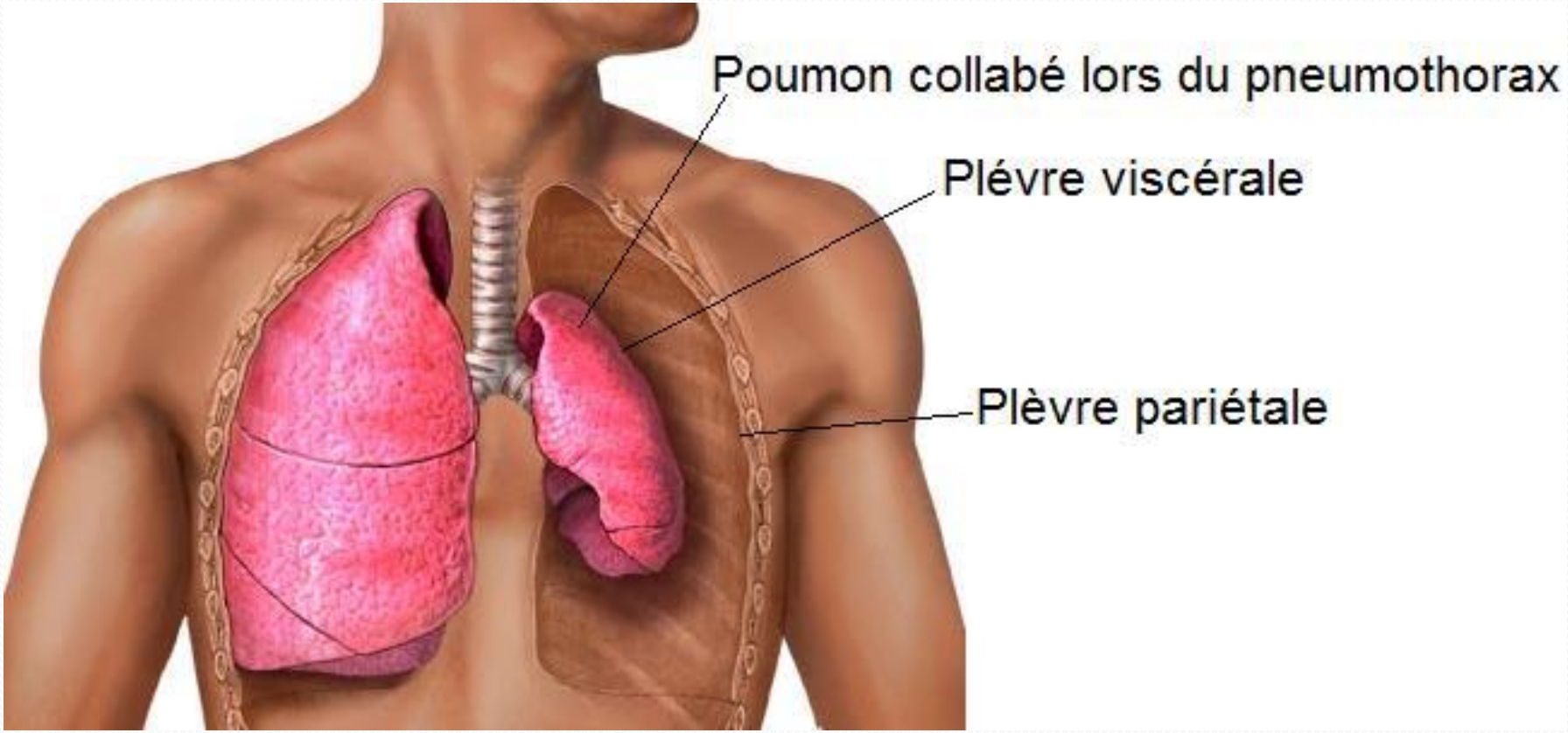
PNEUMOTHORAX

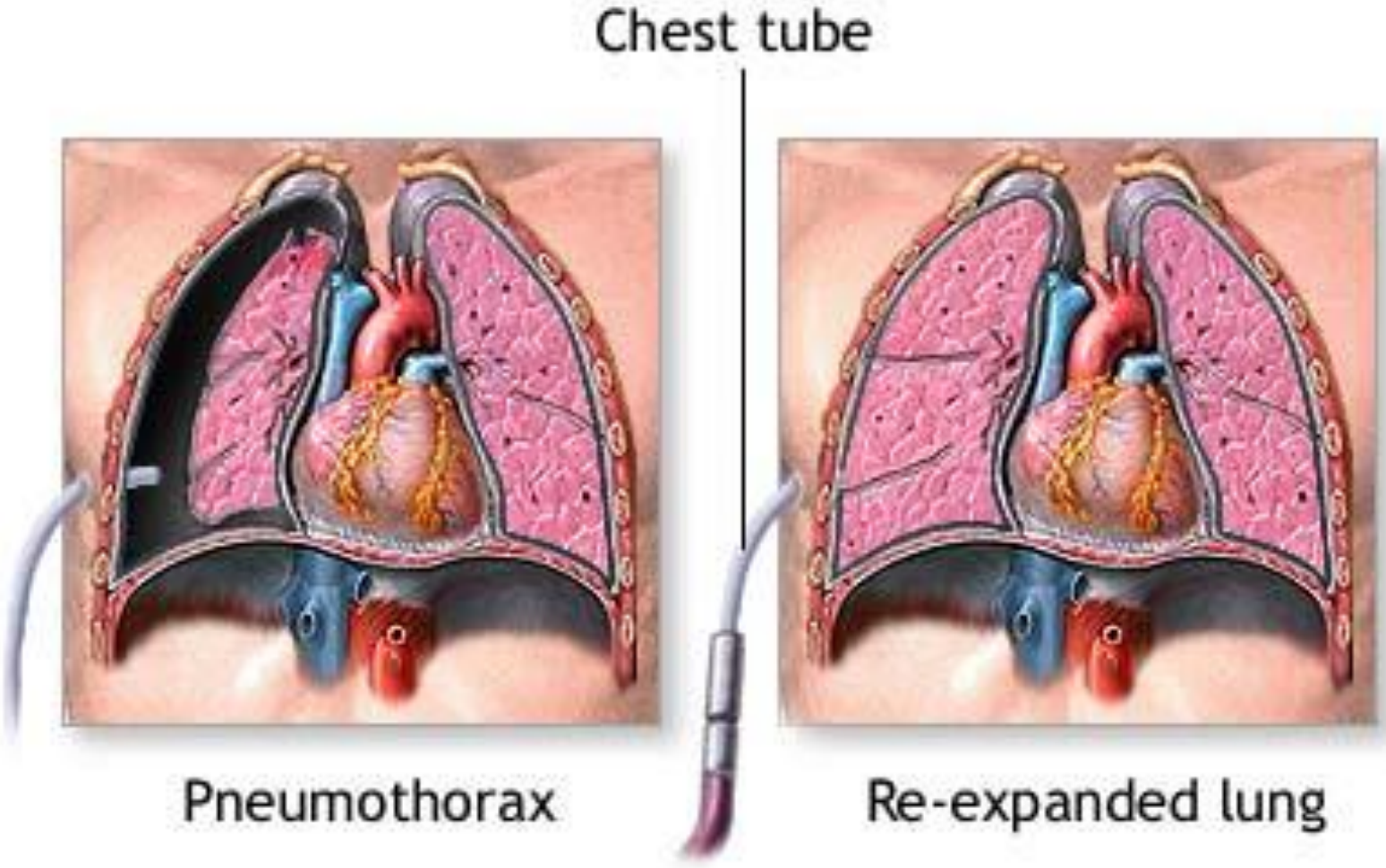
- acute onset of dyspnea.
- tachycardia,
- decreased breath sounds,
- decreased tactile fremitus,
- a pleural friction rub,
- Subcutaneous emphysema,
- hyperresonance,
- tracheal shift to the opposite side

Diagnosis PNEUMOTHORAX

- Upright chest radiograph.
- visceral pleura separates from the parietal pleura

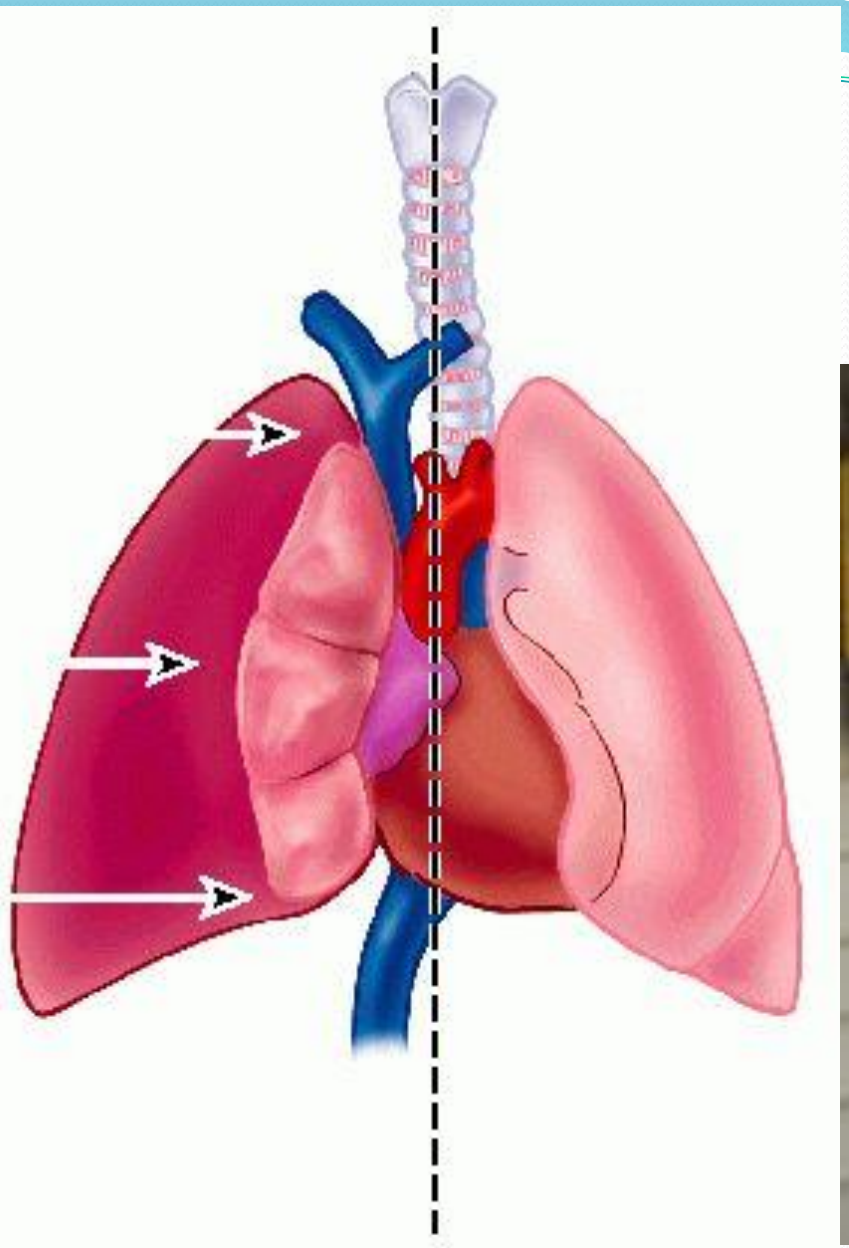
Pneumothorax

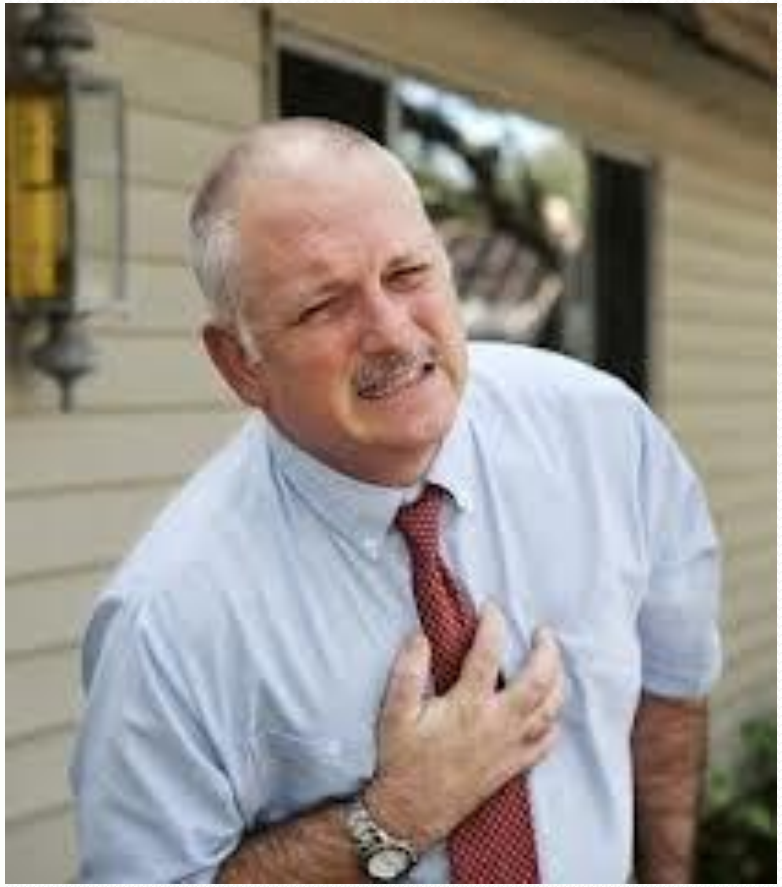


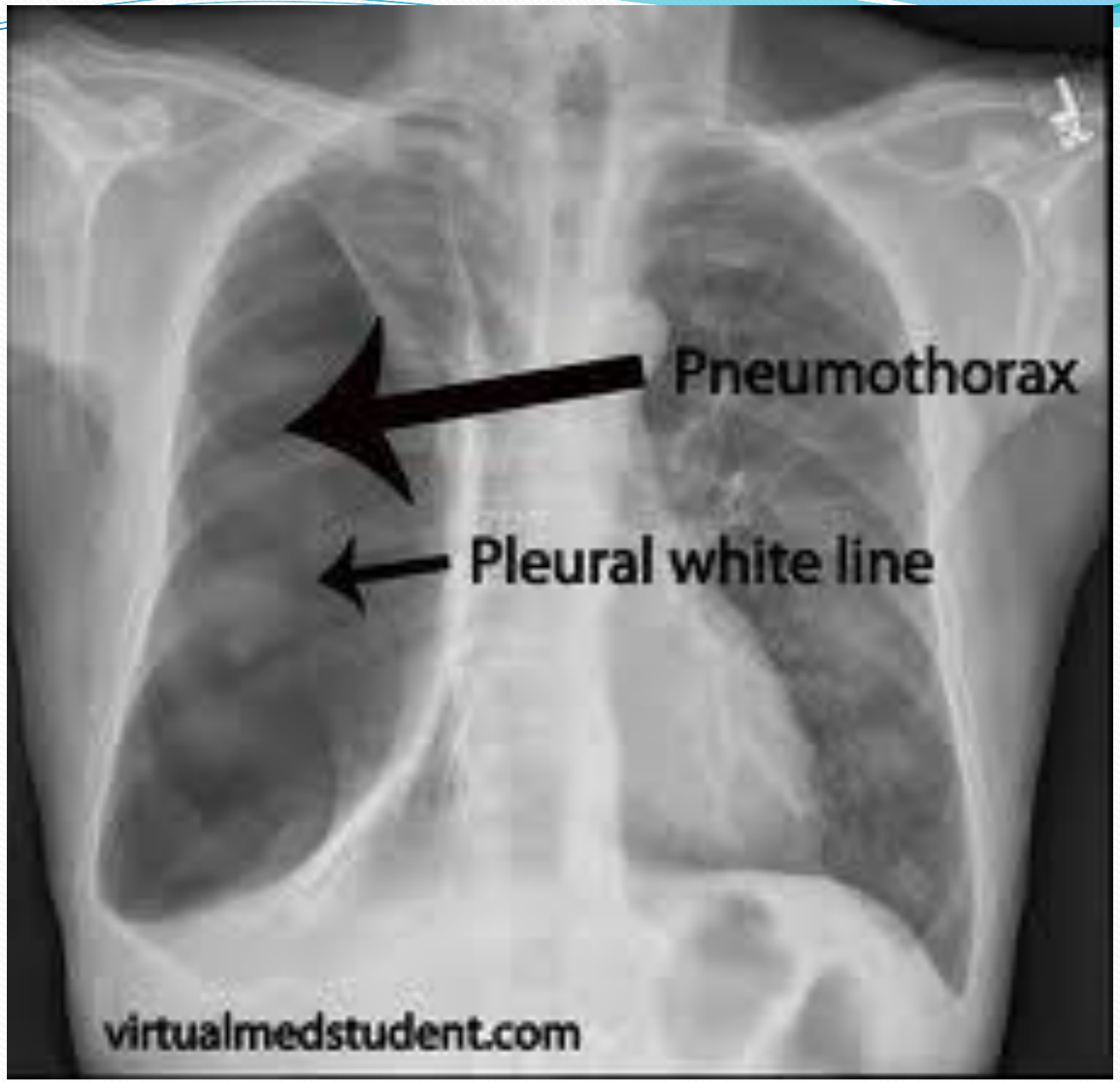


A.D.A.M.

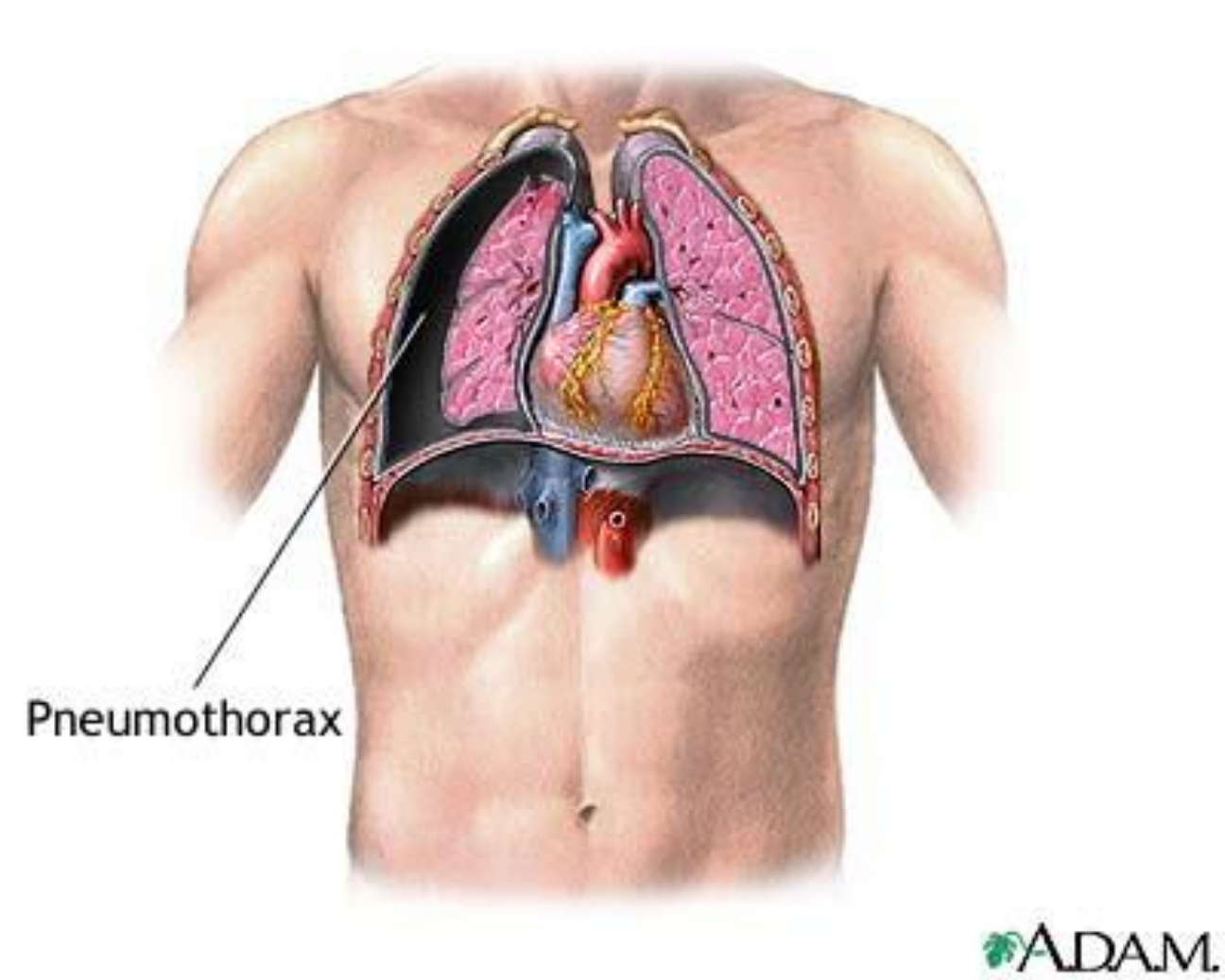
Pneumothorax

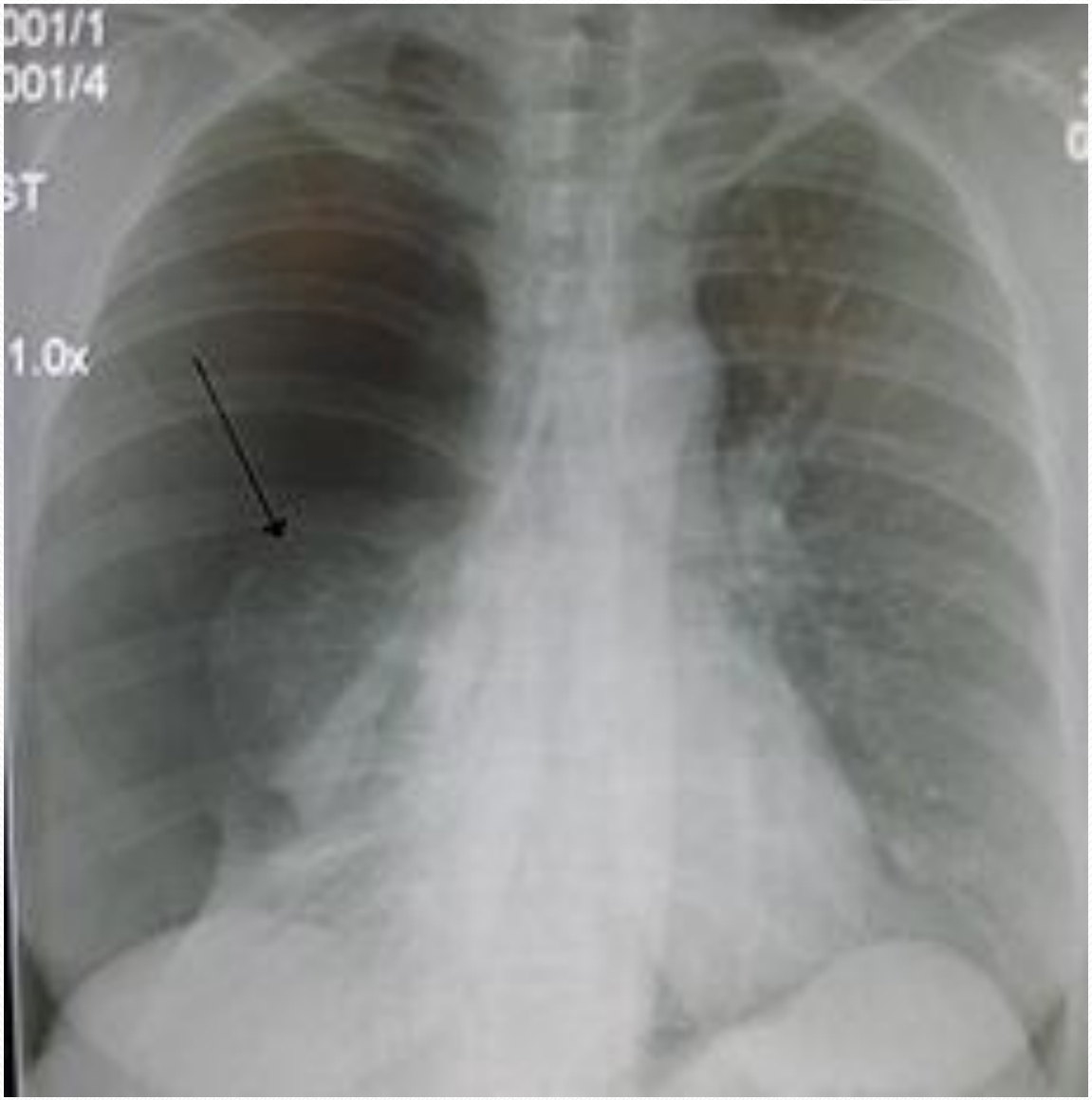


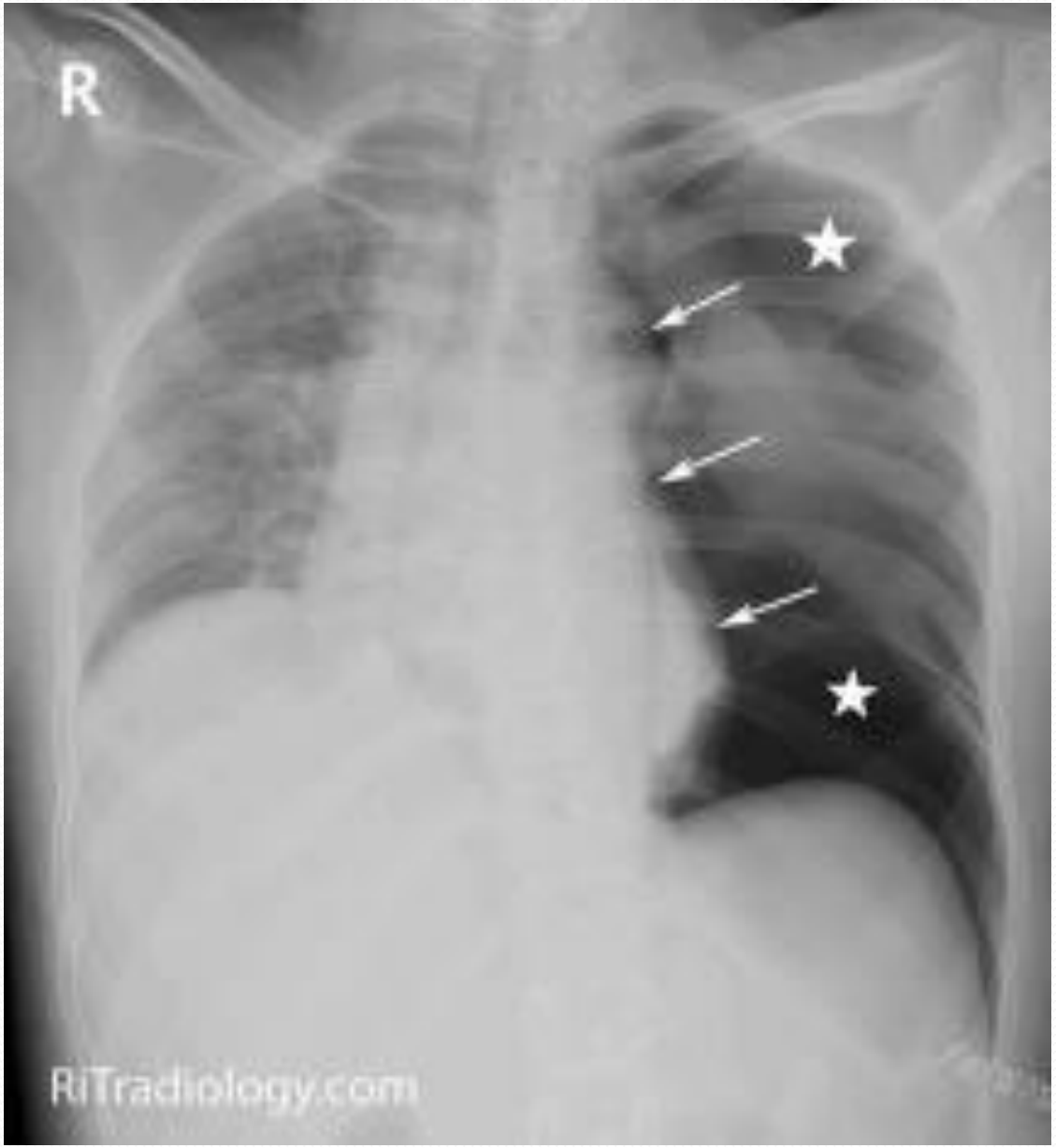



Pneumothorax
Pleural white line
virtualmedstudent.com

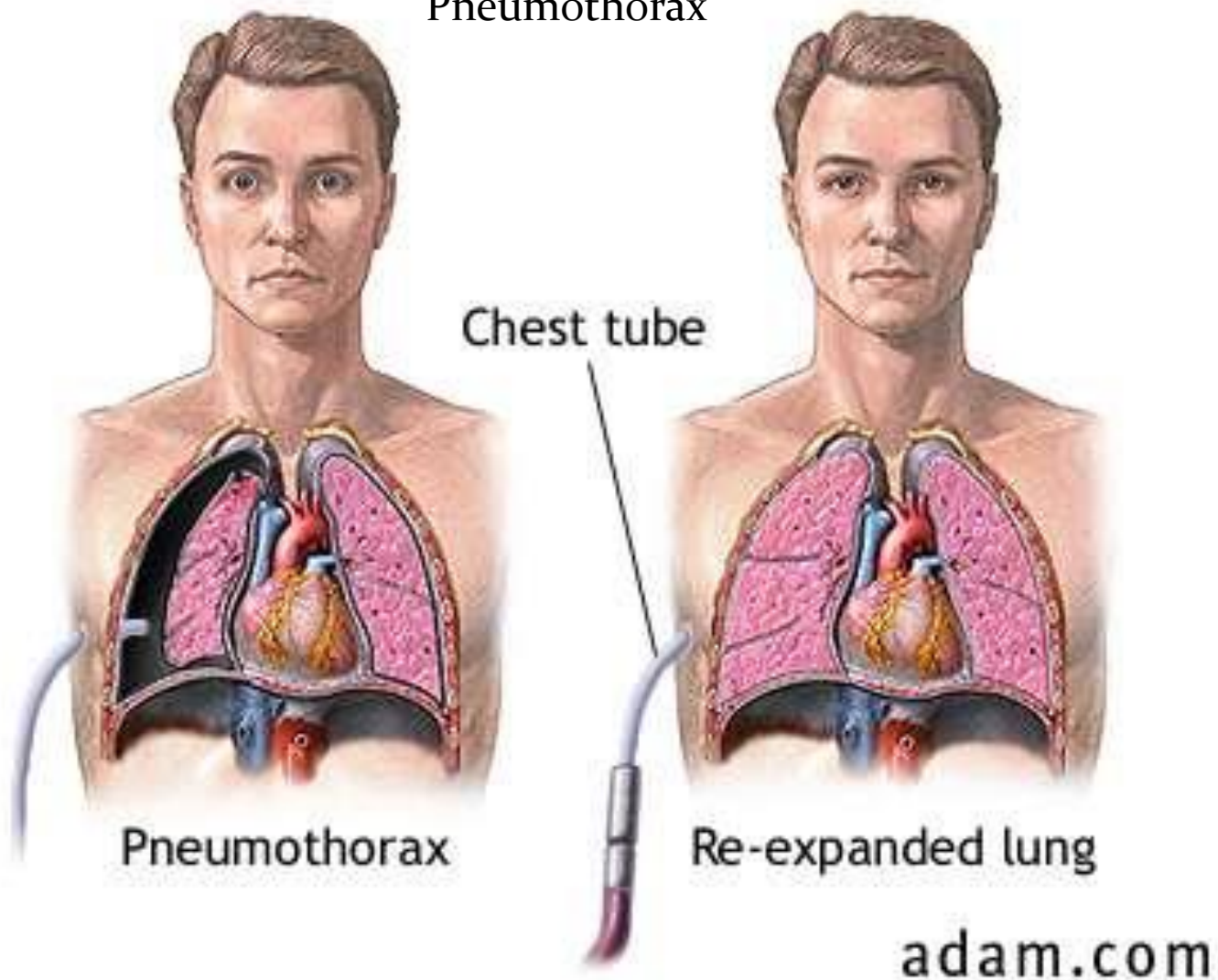
Pneumothorax




001/1
001/4
ST
1.0x


R
RiTradiology.com

Pneumothorax



Pneumothorax

- spontaneously
- Secondary to underlying lung disease.

Pneumothorax

- **Spontaneous pneumothorax**

- Tall
- Young
- Thin
- Men

- **Rupture of apical blebs**

Secondary

- Underlying lung diseases

- emphysema,
- cystic fibrosis,
- granulomatosis inflammation,
- Necrotizing pneumonia,
- pulmonary fibrosis
- lung abscess

PNEUMOTHORAX

- **Acute onset of dyspnea**
- tachycardia,
- decreased breath sounds
- decreased tactile fremitus,
- pleural friction rub,
- Subcutaneous emphysema,
- Hyperresonance
- tracheal shift to the opposite side

Diagnosis

- Upright chest radiograph
- visceral pleura separates from the parietal pleura
- An end-expiratory radiograph

Management

- insertion of a thoracostomy tube
- suction followed by water-seal drainage

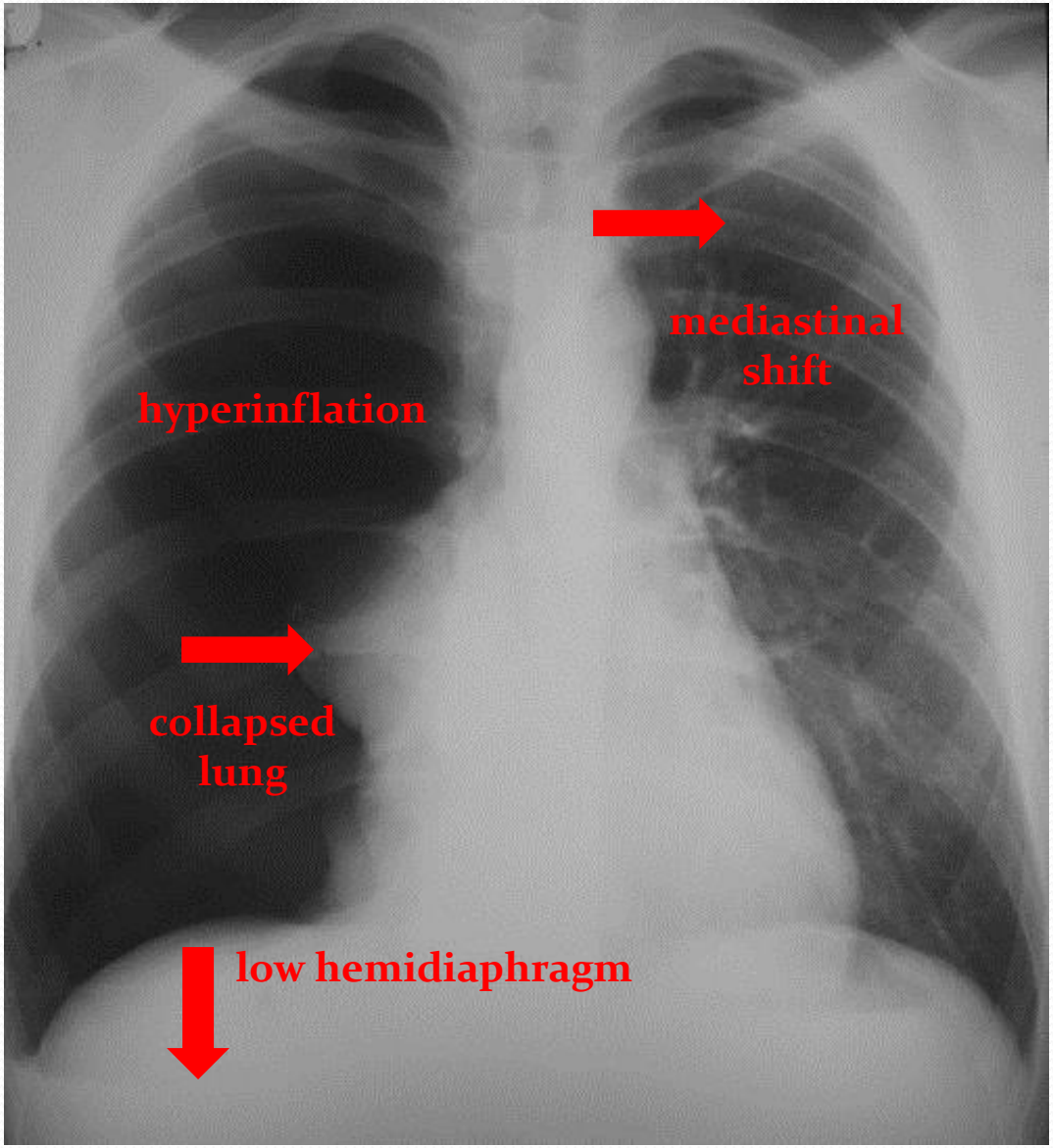
- If the pneumothorax is small and the patient is not in distress, observation alone

tension pneumothorax

- medical emergency
- immediate decompression by placement of a chest catheter

- mediastinal shift
- Compression of the vena cava and heart
- hemodynamic compromise

tension pneumothorax



Pneumothorax

- Blunt trauma
- Penetrating trauma
- air may leak into the pleural space through the chest wall or the lung

Pneumothorax

- **Mechanical ventilation**

- A sudden rise in peak airway pressures
- Reduction in breath sounds

Primary spontaneous pneumothorax

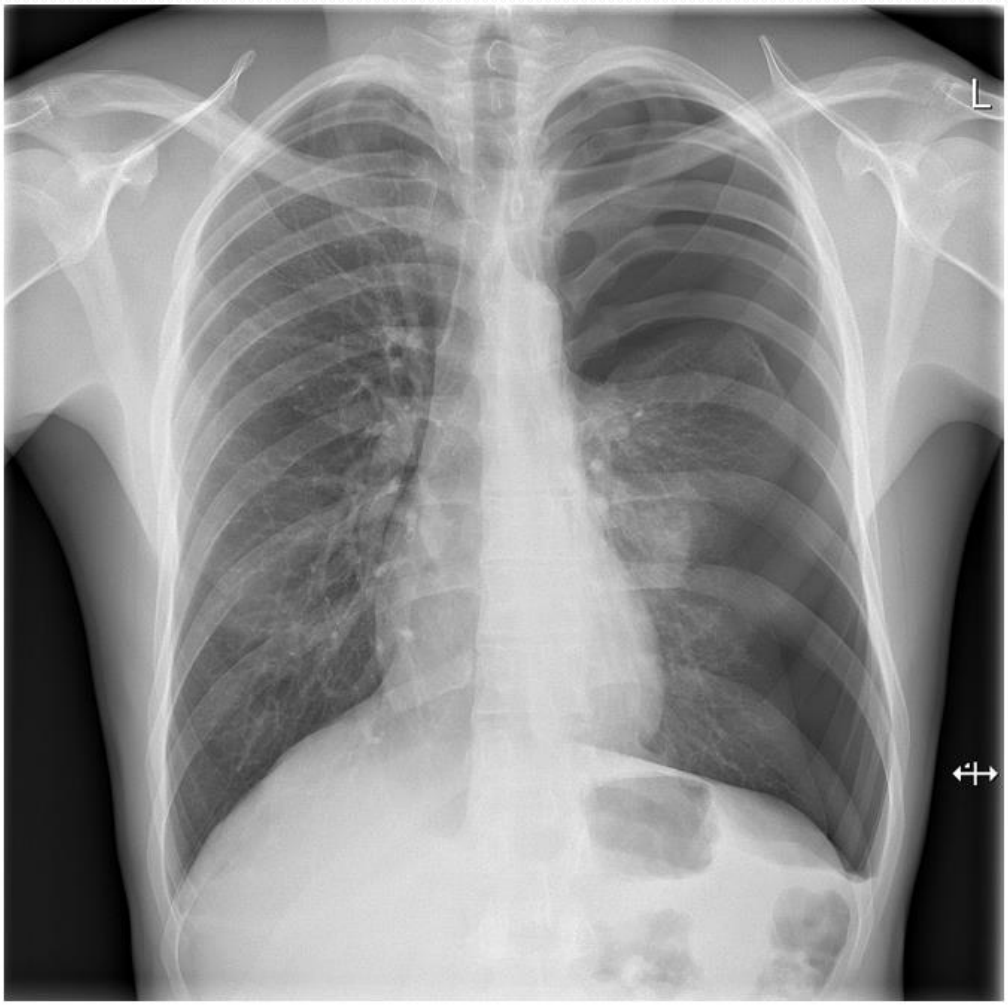


Figure 4 A chest X-ray showing a left-sided primary spontaneous pneumothorax.

Pneumothorax

- Spontaneously
- Secondary to underlying lung disease
- Emphysema
- Cystic fibrosis
- Granulomatosis inflammation
- Necrotizing pneumonia
- Pulmonary fibrosis
- lung abscess

Catamenial pneumothorax

- Subpleural and diaphragmatic endometriosis
- rupture of the endometrial nodules at the time of menstruation

- pneumothorax.

pneumothorax due to a carcinoma of the right lower lobe

MESOTHELIOMA

- neoplasms arising from serosal membranes of the body cavities

- Eighty percent of mesotheliomas originate in the pleural space
- older than 55 years
- asbestos exposure in the distant past

MESOTHELIOMA

- **Symptoms**

- shortness of breath
- chest pain
- weight loss

MESOTHELIOMA

- **most common radiologic presentation**

- large unilateral pleural effusion
- circumferential pleural thickening
- calcified pleural plaque and effusions

Mediastinal Disease

Mediastinal Disease

- Central part of the thoracic cavity
- Between the lungs that contains the heart and aorta
- Esophagus
- Trachea
- Lymph nodes
- Thymus

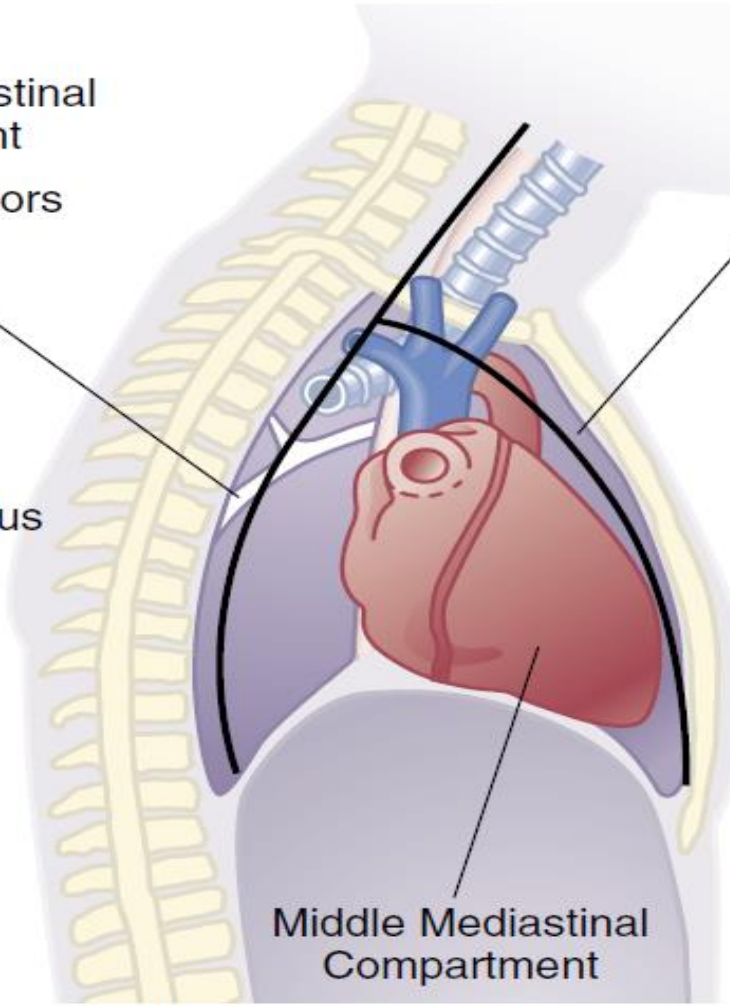
The mediastinum

- Two pleural cavities laterally
- Diaphragm inferiorly
- Thoracic inlet superiorly

The mediastinum

- **Three compartments:**

- Anterior
- Middle
- Posterior


Posterior Mediastinal Compartment
Neurogenic tumors and cysts
Meningocele
Lymphoma
Esophageal disease
Megaesophagus
Diverticula
Neoplasm
Bochdalek hernia
Aneurysm
Anterior Mediastinal Compartment
Thymomas
Substernal thyroid
Parathyroid lesions
Germinal cell neoplasms
Lymphomas
Middle Mediastinal Compartment
Bronchogenic cysts
Pleuropericardial cysts
Lymphadenopathy
Sarcoidosis
Malignancy—carcinoma and lymphoma
Granulomatous disease
Aneurysms
Morgagni hernia

Anterior mediastinal compartment

- **Lymphatic tissue**
- **Thymus**
- **Great veins**

- **thymomas**
- **germ cell tumors**
- **lymphomas**
- **intrathoracic thyroid tissue**
- **parathyroid lesions**

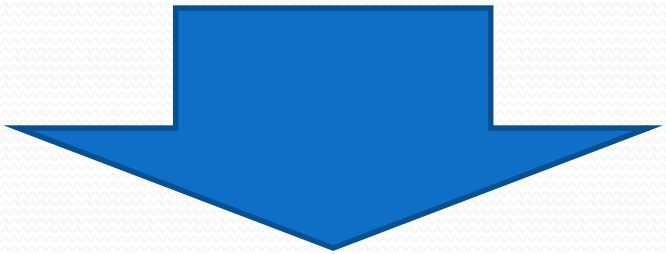
Anterior mediastinal compartment

- **Thymomas**

- 20% of mediastinal neoplasms in adults,
- most common anterior mediastinal primary neoplasm in adults.
- myasthenia gravis may be present in one third of patients with thymoma

Anterior mediastinal compartment

- Patients with systemic lymphoma
- 5% to 10% of patients with lymphoma



- present with primary mediastinal lesions

Posterior mediastinal masses

- Neurogenic tumors
- Cysts
- Meningocele
- Lymphoma
- Aneurysm of the aorta
- Esophageal disorders such as diverticula and neoplasm

Cysts found in the mediastinum

- pericardial cysts,
- Bronchogenic cysts,
- enteric cysts,
- thymic cysts,
- thoracic duct cysts

All these are benign but can produce compressive symptoms

Lung cancer

- Lung cancer can present with mediastinal adenopathy,
- a sign of unresectable disease

MEDIASTINITIS

- Inflammation of the mediastinal structures
- Acute
- Chronic

MEDIASTINITIS

- **Acute mediastinitis**

- rapidly progressive condition secondary to infection
- iatrogenic secondary to invasive procedures

- esophageal or tracheobronchial rupture
- result of trauma and tissue necrosis

MEDIASTINITIS

- **Chest imagining studies**

- widening of the mediastinum
- Pneumothorax
- Hydrothorax

Treatment

- antibiotics,
- pleural drainage
- Mediastinal evacuation.

Chronic mediastinitis (fibrosing mediastinitis)

- progressive illness
- granulomatous infections
- neoplasm,
- Radiotherapy
- occasionally drugs such as methysergide
- idiopathic

Chronic mediastinitis (fibrosing mediastinitis)

- asymptomatic until vascular or neurologic structures are affected.
- Superior vena cava syndrome
- often require surgical exploration

Chest Wall Disease

- **bony structures of the rib cage**

- Ribs and the vertebrae
- Diaphragm
- Respiratory muscles

SKELETAL DISEASE

- Kyphoscoliosis
- ankylosing spondylitis

- spine and its articulations;
- pectus excavatum

- involves the sternum,
- flail chest
- affects the ribs

stiffening the chest wall

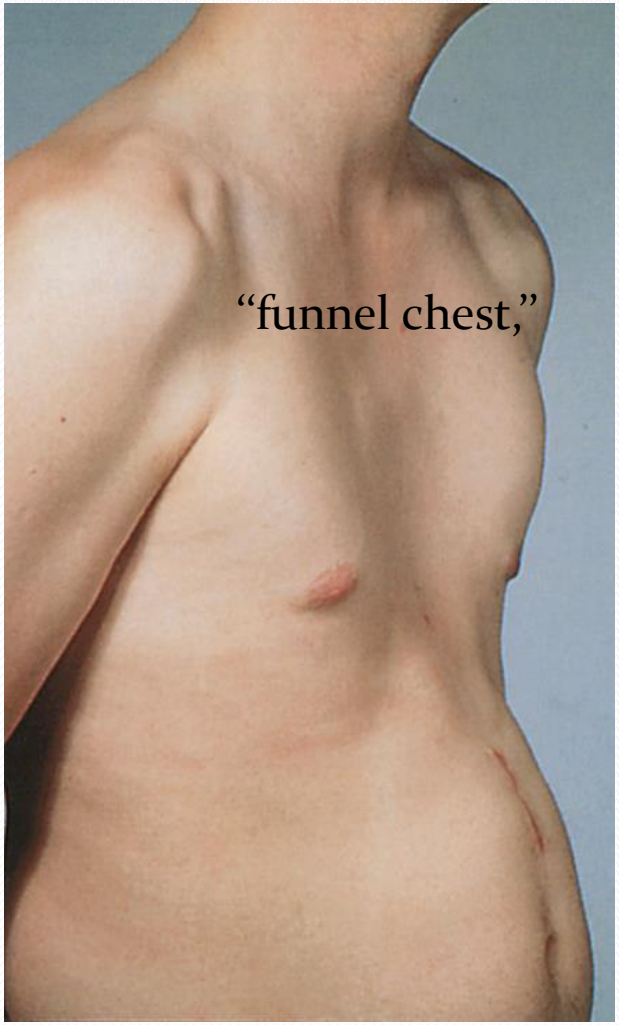
SKELETAL DISEASE

- Obesity

- Soft tissue mass of the ribcage and abdomen

kyphoscoliosis

Pectus excavatum



abnormalities of the mitral valve, especially mitral valve prolapse.

Pectus carinatum

SKELETAL DISEASE

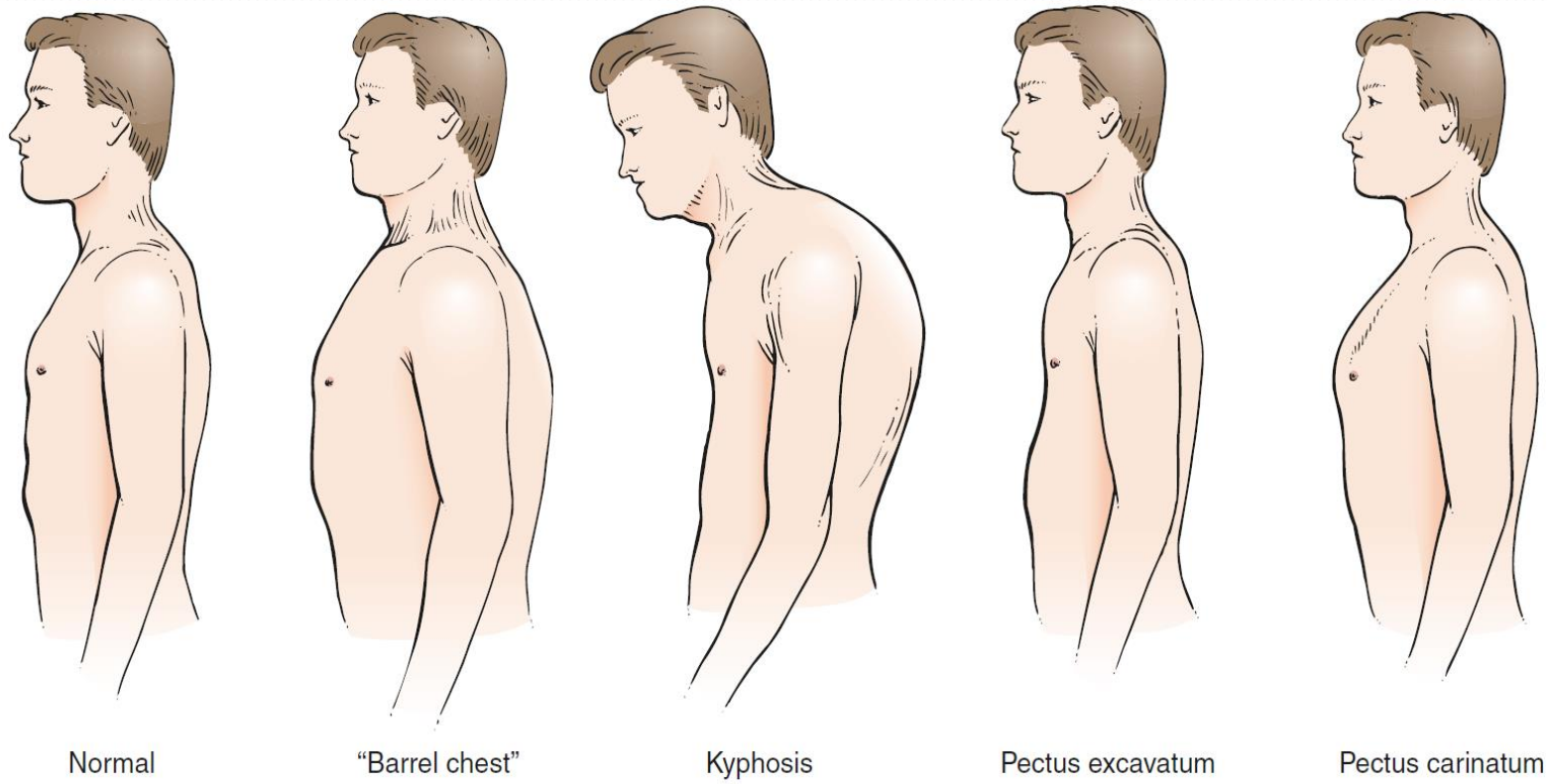


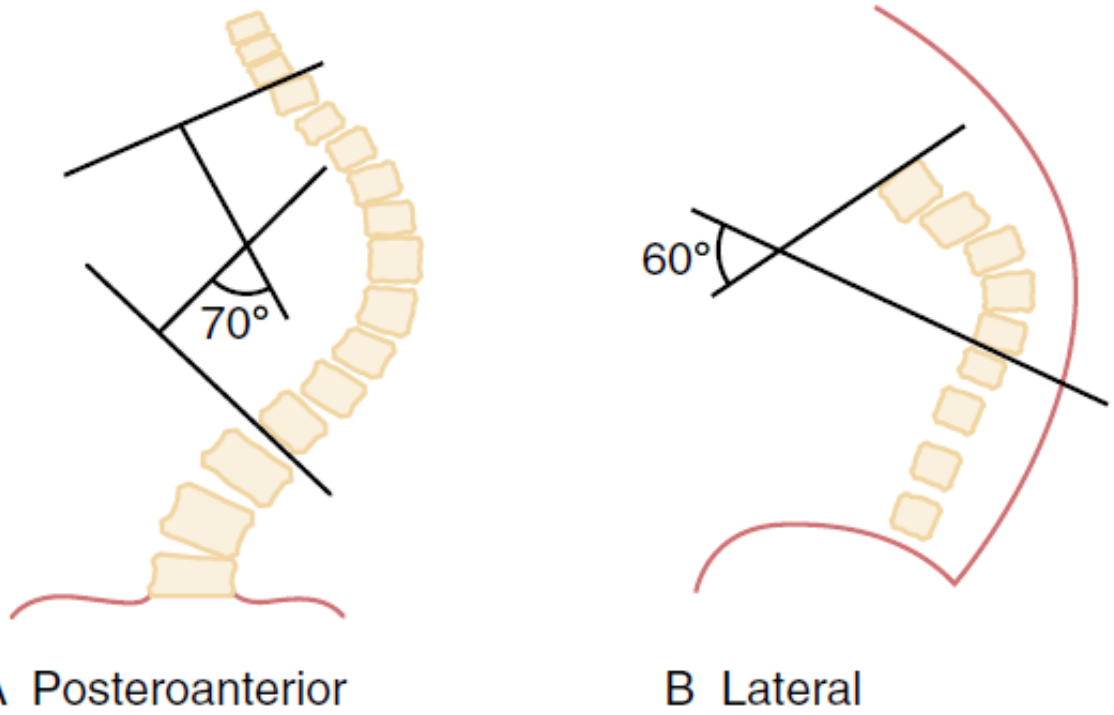
Figure 13-9 Common chest configurations.

kyphoscoliosis

- produces the most severe restrictive impairment
- Excessive spinal curvature in the
- lateral plane (scoliosis)
- sagittalplane (kyphosis)

- Degree of curvature can be assessed by measuring the Cobb angle

Kyphoscoliosis



A Posteroanterior B Lateral

Figure 21-2 Schematic depicting the lines constructed to measure the Cobb angle of scoliosis (**A**) and kyphosis (**B**).

Kyphoscoliosis

- May be due to neuromuscular disease
- Congenital vertebral malformations
- Idiopathic

- late childhood or early adolescence
- Females more than males (ratio of 4 : 1).
- Multigene condition with autosomal or sex-linked inheritance and variable phenotypic expression

OBESITY

- major health problem throughout the world
- affecting both children and adults
- Body fat usually constitutes
- 15% to 20% of body mass in healthy men
- 25% to 30% of body mass in healthy women

OBESITY

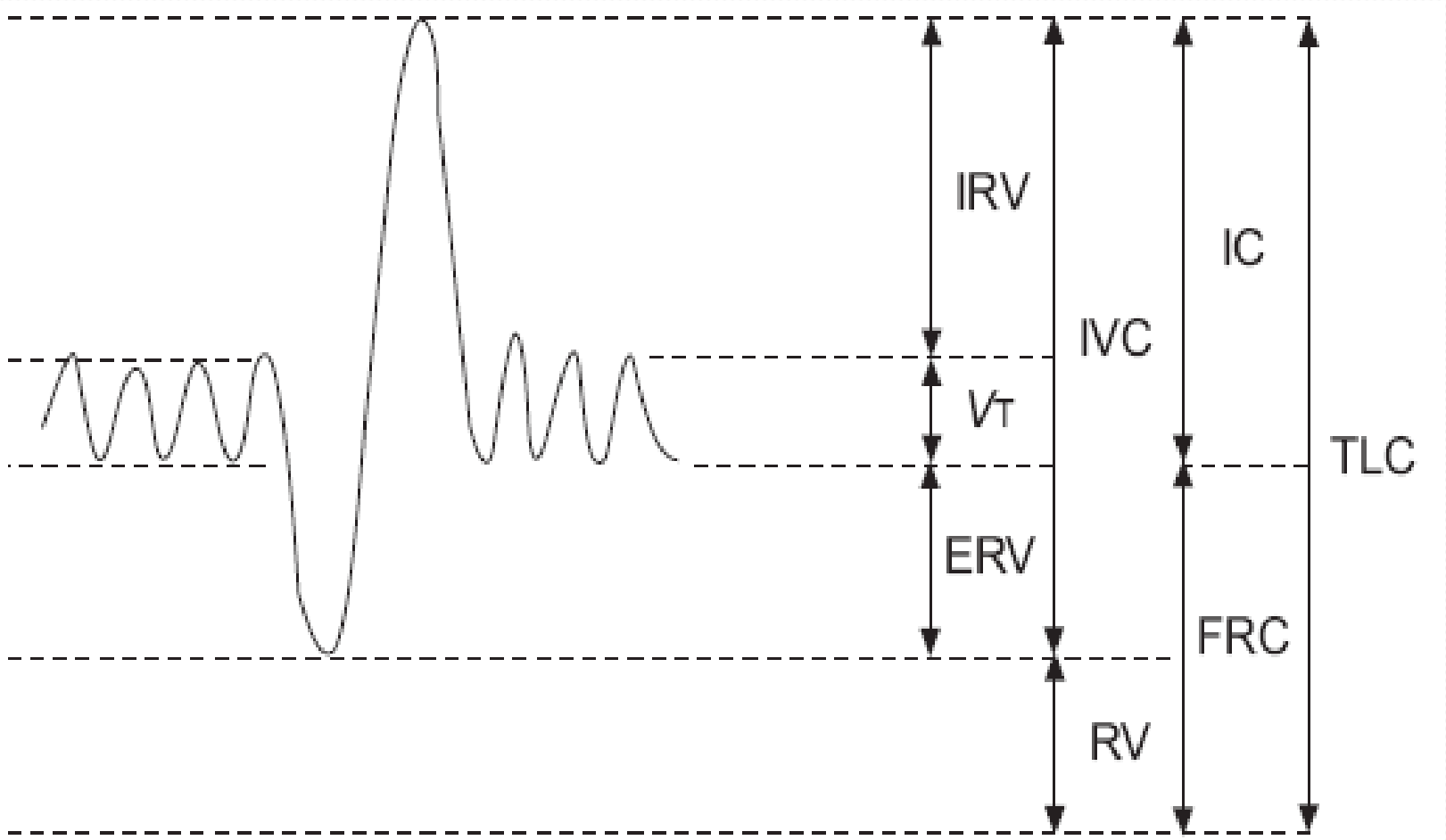
- degree of obesity can be assessed
- body mass index (BW/Ht^{2})
- BMI between 18.5 and 24.9 kg/m2 are normal
- BMI greater than 40 kg/m2 are considered severely or morbidly obese

OBESITY

- ↓ Functional residual capacity
- ↓ Expiratory reserve volume

Most common pulmonary function abnormalities

Lung Volumes & Capacities



Obesity

- When obesity is associated with hypoventilation

- ***Obesity-hypoventilation syndrome (pickwickian syndrome)***
- Chronic hypoventilation and pulmonary hypertension
- Nocturnal noninvasive positive-pressure ventilation
- Weight loss is the optimal therapy

Obesity

- long-term weight loss maintenance
- Pharmacotherapy
- Bariatric surgery

- Conventional therapy (diet, enhanced physical activity, and behavioral therapy)

DIAPHRAGM PARALYSIS

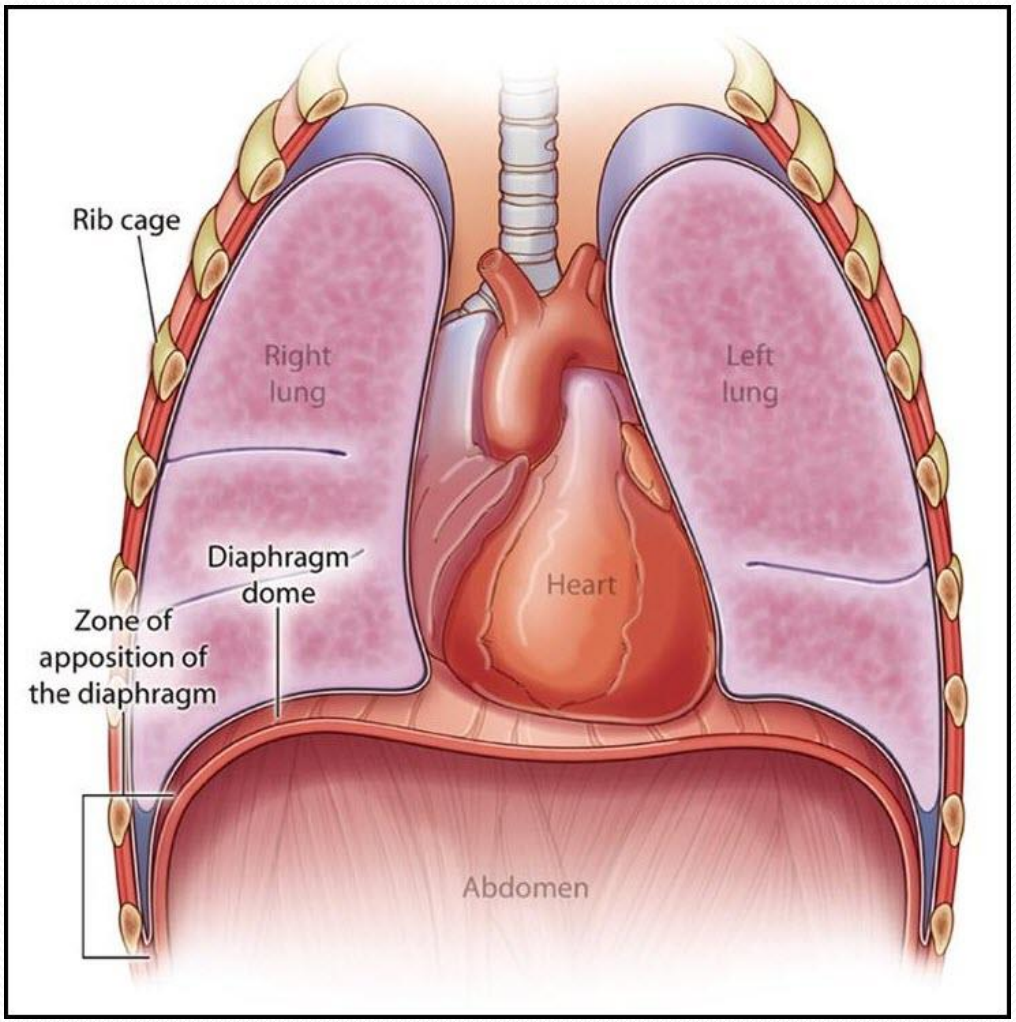
The diaphragm separates the thorax from the abdomen

- major muscle of inspiration
- Unilateral diaphragm paralysis is more common than bilateral diaphragm paralysis.

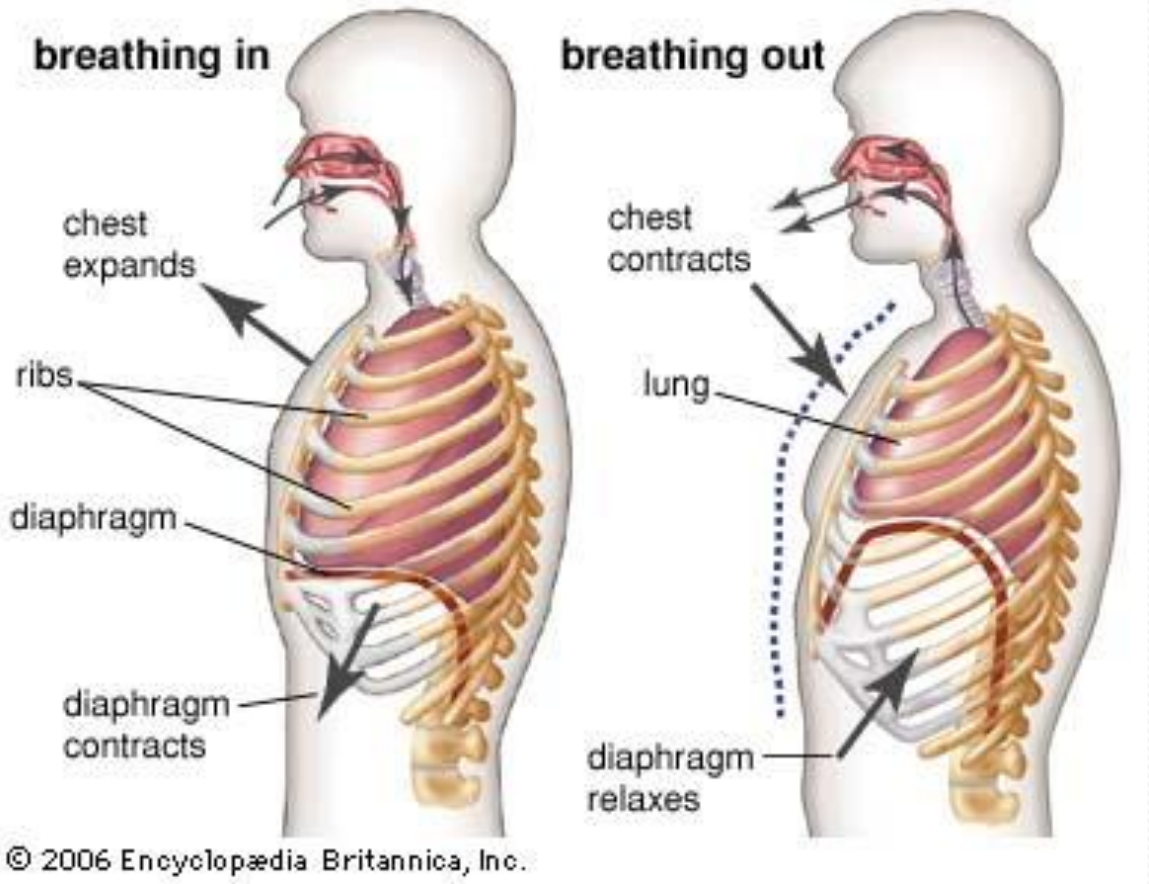
Causes of unilateral paralysis

- Traumatic phrenic nerve injury
- Herpes zoster
- Cervical spinal disease
- Compressive tumors

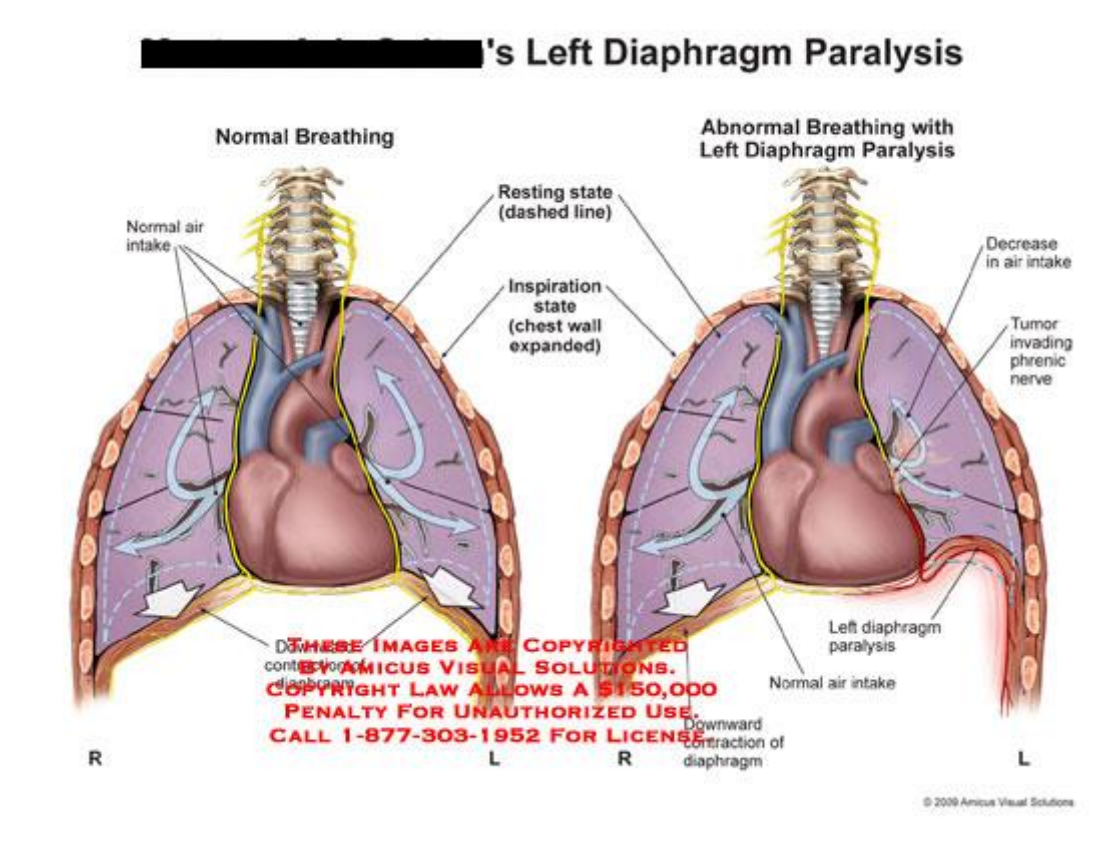
Normal diaphragm



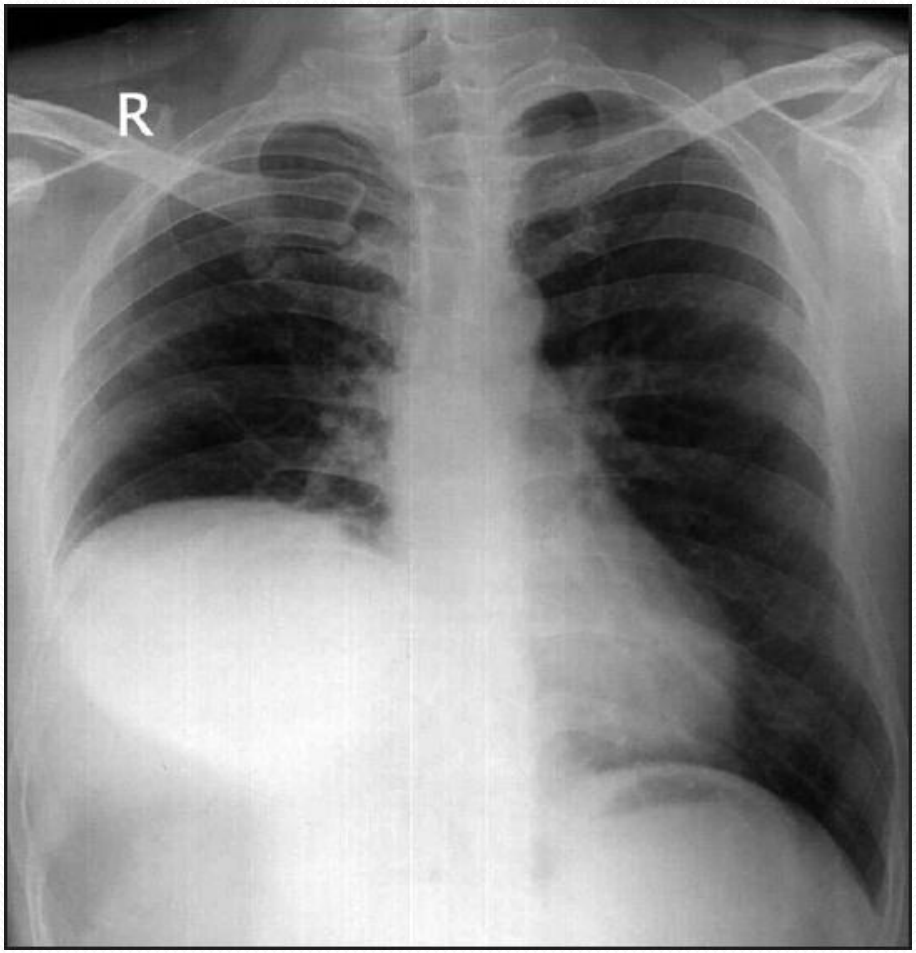
Normal diaphragm



Unilateral paralysis



Unilateral paralysis



Bilateral diaphragm paralysis

- generalized muscle weakness
- motor neuron disease (amyotrophic lateral sclerosis)
- Orthopnea
- Difficulty sleeping in the supine position
- Pulmonary function tests are associated with severe restrictive impairments

- supine position
- reduction in vital capacity by as much as %٥٠

Bilateral diaphragm paralysis

- recovery has been noted in more than 50% of
- idiopathic diaphragm paralysis or paralysis due to neuralgic amyotrophy (brachial plexus neuritis)

- Nocturnal hypoventilationcan be treated with

- Noninvasive positive pressure ventilation

Bilateral diaphragm paralysis